

# **San Diego Bay National Wildlife Refuge**

*Sweetwater Marsh and  
South San Diego Bay Units*

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*Comprehensive Conservation  
Plan and Environmental Impact  
Statement*

*Volume I, August 2006*

Comprehensive Conservation Plans provide long-term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes and identify the Service's best estimate of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. The plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

# **San Diego Bay National Wildlife Refuge**

## **Sweetwater Marsh and South San Diego Bay Units**

### *Final Comprehensive Conservation Plan and Environmental Impact Statement*

#### *Volume I – August 2006*

#### **Vision Statement**

The San Diego Bay National Wildlife Refuge protects a rich diversity of endangered, threatened, migratory, and native species and their habitats in the midst of a highly urbanized coastal environment. Nesting, foraging, and resting sites are managed for a diverse assembly of birds. Waterfowl and shorebirds over-winter or stop here to feed and rest as they migrate along the Pacific Flyway. Undisturbed expanses of cordgrass-dominated salt marsh support sustainable populations of light-footed clapper rail. Enhanced and restored wetlands provide new, high quality habitat for fish, birds, and coastal salt marsh plants, such as the endangered salt marsh bird's beak. Quiet nesting areas, buffered from adjacent urbanization, ensure the reproductive success of the threatened western snowy plover, endangered California least tern, and an array of ground nesting seabirds and shorebirds.

The San Diego Bay National Wildlife Refuge also provides the public with the opportunity to observe birds and wildlife in their native habitats and to enjoy and connect with the natural environment. Informative environmental education and interpretation programs expand the public's awareness of the richness of the wildlife resources of the Refuge. The Refuge serves as a haven for wildlife and the public to be treasured by this and future generations.

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*August 2006*

**San Diego Bay National Wildlife Refuge (NWR)  
Sweetwater Marsh and South San Diego Bay Units  
Final Comprehensive Conservation Plan  
and Environmental Impact Statement  
San Diego County, California**

Type of Action: Administrative

Lead Agency: U.S. Department of the Interior, Fish and Wildlife Service

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**Abstract:** The Final CCP/EIS includes revisions to the draft CCP/EIS, which was circulated for public review and comment between July 22, 2005 and September 19, 2005. Substantive changes to the draft CCP/EIS text, which were made in response to or as a result of comments received during public review, are indicated in the Final CCP/EIS using an underlined text format. All comments received on the draft CCP/EIS, the Service's responses to these comments, and a list of the Final CCP/EIS recipients have also been incorporated into the Final CCP/EIS.

The San Diego Bay National Wildlife Refuge (NWR) consists of two units; the Sweetwater Marsh Unit and the South San Diego Bay Unit. Three alternatives, including a Preferred Alternative and a No Action Alternative, are described, compared, and assessed for the Sweetwater Marsh Unit of the San Diego Bay NWR and four alternatives, including a Preferred Alternative and a No Action Alternative, are described, compared, and assessed for the South San Diego Bay Unit of the San Diego Bay NWR. In each case, Alternative A is the No Action Alternative, as required by the National Environmental Policy Act regulations. The alternatives for each Refuge Unit are summarized below:

**Sweetwater Marsh Unit**

**Alternative A – No Action:** This alternative assumes no change from past management programs and serves as the baseline to which all other action alternatives are compared. There would be no major changes in habitat management or the current public use program under this alternative.

**Alternative B – Implement Habitat Enhancement and Expand Environmental**

**Interpretation:** This alternative expands current management activities to emphasize enhancement of existing salt marsh habitat, including enhancement of high marsh areas to support the recovery of the endangered salt marsh bird's beak. Improvements in tidal and freshwater circulation within the marsh are also proposed to enhance habitat quality for the endangered light-footed clapper rail. The existing public uses on the Refuge would continue and new opportunities for environmental interpretation are identified for Paradise Marsh and the F&G Street Marsh.



**Alternative C (Preferred Alternative) – Implement Habitat Enhancement and Restoration and Improve Existing Public Uses:** The management activities described for Alternative B would be expanded under this alternative to include restoration of intertidal and upland habitat. The existing trail system on Gunpowder Point would be redesigned and new interpretive elements would be provided to better complement the existing environmental education programs supported by the Refuge.

#### **South San Diego Bay Unit**

**Alternative A – No Action:** This alternative assumes no change from past management programs and serves as the baseline to which all other action alternatives are compared. There would be no major changes in habitat management or the current public use program under this alternative.

**Alternative B – Expand Habitat Management and Enhance Nesting Opportunities:** This alternative expands current management activities to emphasize enhancement of nesting opportunities around the salt ponds for the endangered California least tern, threatened western snowy plover, and various other colonial seabirds. Enhancements would include the creation of approximately 18 acres of new nesting habitat within the salt works, capping of existing levees with sand, and recontouring levee side slopes to provide better access to foraging areas. A public awareness program would be implemented to reduce wildlife disturbance in the bay and avoid the accumulation of fishing line and other debris. The Refuge's current public use program would remain unchanged.

**Alternative C – Expand Habitat Management, Enhance Nesting Opportunities, Implement Habitat Restoration, and Expand Existing Public Use Opportunities:** In addition to the nesting enhancements and other management actions described in Alternative B, this alternative would involve the restoration of portions of the salt ponds and all of the Otay River floodplain. Two restoration options are presented for both the salt ponds and the Otay River floodplain that could result in the restoration of up to 410 acres of intertidal habitat in the salt works and 140 acres of intertidal salt marsh, freshwater wetlands, and native uplands within the Otay River floodplain. Restoration would emphasize the creation of cordgrass-dominated salt marsh to support the endangered light-footed clapper rail. The commercial solar salt operation would continue within a reduced footprint and opportunities for fishing and wildlife observation would increase.

**Alternative D (Preferred Alternative) – Expand Habitat Management, Enhance Nesting Opportunities, Maximize Habitat Restoration, and Provide Additional Public Use Opportunities:** Under this alternative, the restoration potential within the salt ponds would be maximized. Approximately 650 acres of salt ponds would be restored to tidal influence, 36 acres of new nesting habitat would be provided, 275 acres of pond area would be managed to benefit waterfowl and shorebird foraging and nesting, 45 acres of pond area would be managed to maintain a source of brine invertebrates within the system, and the majority of the levees would be preserved and maintained as nesting habitat for ground nesting birds. The Otay River floodplain would be restored as described in Alternative C. Opportunities for wildlife observation, photography, and environmental interpretation would be expanded and the other public uses that are currently provided on this Refuge Unit would be maintained.

# *Reader's Guide*

The U.S. Fish and Wildlife Service (Service) will manage the Sweetwater Marsh and South San Diego Bay Units of the San Diego Bay National Wildlife Refuge (NWR) in accordance with an approved Comprehensive Conservation Plan (CCP). This CCP provides long range guidance on Refuge management through its vision, goals, objectives, and strategies. The CCP also provides a basis for a long-term adaptive management process including implementation, monitoring progress, evaluating and adjusting, and revising plans accordingly. Additional step-down planning will be required prior to implementation of the various restoration and major public use proposals included in the CCP.

In accordance with the Service's CCP Policy, the CCP and Environmental Impact Statement (EIS) have been combined into one document, referred to as the CCP/EIS. The Final CCP/EIS incorporates revisions to the draft CCP/EIS in response to comments received during the public comment period. Substantive changes are indicated using an underlined text format. The Service will publish a Record of Decision (ROD) that identifies the selected alternative for each Refuge Unit no sooner than 30 days following the publication of the Notice of Availability of the Final CCP/EIS in the Federal Register. Once the ROD is signed, the Final CCP made up of Chapter 1, the selected alternative for each Refuge Unit from Chapter 2, all of Chapters 3 and 5, and Appendices A, C, D, K, and M will be prepared. The following chapter and appendix descriptions are provided to assist readers in locating and understanding the various components of this combined document.

**Chapter 1, *Introduction, Purpose and Need, and Issues***, includes the regional context, establishment, and purposes of the Sweetwater Marsh and the South San Diego Bay Units; vision and goals for future management of the Refuge; and the purpose of and need for a CCP. Future step-down planning, subsequent analysis under NEPA, and permit approvals needed to implement various aspects of the CCP are outlined and legal and policy guidance for managing the Refuge as part of the National Wildlife Refuge System (NWRS) are summarized. This chapter also provides background on major planning issues identified by Refuge staff, Federal, Tribal, State, and local agencies, and the general public.

**Chapter 2, *Alternatives***, describes the various management alternatives proposed for the two Refuge Units. Three alternatives are presented for the Sweetwater Marsh Unit and four alternatives are described for the South San Diego Bay Unit. Each alternative represents a different approach to achieving the vision, goals, and objectives for the Refuge Unit. Alternative A (No Action) describes current management practices. Alternative C is the Preferred Alternative for the Sweetwater Marsh Unit and Alternative D is the Preferred Alternative for the South San Diego Bay Unit.

**Chapter 3, *Affected Environment***, describes the existing physical and biological environment, public uses, cultural resources, and socioeconomic conditions. They represent baseline conditions for the comparisons made in Chapter 4.

**Chapter 4, *Environmental Consequences***, describes the potential impacts of each of the alternatives on the resources, programs, and conditions outlined in Chapter 3.

**Chapter 5, *Compliance, Consultation, and Coordination with Others***, outlines the various Federal laws, Executive Orders, regulations, and other guidance pertinent to implementation of the CCP, summarizes public involvement, interagency coordination, and Tribal consultation, and

acknowledges those agencies, organizations, and individuals who provided significant contributions to the CCP process.

**Chapter 6, *List of Preparers and Contributors***, contains the names, positions, education, and years of experience of those individuals directly involved in the analysis and writing the draft CCP/EIS. The names and positions of those who contributed in other ways to the preparation of the document or the accompanying step-down plans are also included.

**Chapter 7, *Reference Cited***, provides bibliographic references for the citations in this document.

**Chapter 8, *Index***, indicates where the concepts or subject areas that may be of interest to the reader are discussed in the document.

**Appendix A, *Glossary of Terms***, contains acronyms, abbreviations, and definitions of terms used in this document.

**Appendix B, *Distribution List***, contains the list of Federal, Tribal, State, and local agencies; nongovernmental organizations; libraries, and individuals who received planning updates, summaries, and other mailings associated with this planning effort including the release of the draft CCP/EIS. Also included is a list of those Federal, Tribal, State and local agencies, individuals, nongovernmental organizations, libraries, and individuals who received a copy of the Final CCP/EIS.

**Appendix C, *Bird Species Lists***, contains the various bird species that have been observed on the Sweetwater Marsh and the South San Diego Bay Units.

**Appendix D, *CCP Implementation***, which has been revised to address comments raised during the public review and comment period, addresses step-down planning, funding, phasing, monitoring, and adaptive management practices as they relate to the various habitat and wildlife management actions included in the preferred alternatives. It also provides cost estimates for proposed public use programs and addresses current and future staffing for the Refuge.

**Appendix E, *Summary of Public Scoping Comments***, presents a summary of the comments provided during public scoping.

**Appendix F, *Description of the Salt Works Operation***, includes a detailed description of how salt is produced within the salt ponds on the South San Diego Bay Unit.

**Appendix G, *Federal and State Ambient Air Quality Standards***, presents the currently adopted Federal and State Ambient Air Quality Standards.

**Appendix H, *Air Quality Calculations***, includes the anticipated air emissions that would be generated from each of the habitat restoration options described for the South San Diego Bay Unit.

**Appendix I, *Hydrodynamic Modeling Report***, describes the methods and results of the hydrodynamic modeling analysis conducted for restoration within the Otay River floodplain.

**Appendix J, *Brine Management Report***, describes the methods and results of the salinity transport modeling conducted to assess the changes in Bay salinities from breaching the salt pond

levees. The report also addresses the feasibility of diluting to acceptable levels the discharge from a hypersaline brine environment proposed in Alternative D for the South San Diego Bay Unit.

**Appendix K, *Compatibility Determinations***, describe uses, anticipated impacts, stipulations, and a determination of compatibility or non-compatibility for all existing and proposed public uses on the Sweetwater Marsh and South San Diego Bay Units.

**Appendix L, *Fire Management Plan for the San Diego NWR Complex***, is a step-down management plan that provides specific guidelines for appropriate fire management within the entire Refuge Complex.

**Appendix M, *Predator Management Plan***, is a step-down management plan that provides guidance and identifies actions to be taken to manage specific predators of listed species on the Refuge.

**Appendix N, *Wilderness Review***, lists the criteria used in conducting a wilderness review and describes why the San Diego Bay NWR does not meet the criteria.

**Appendix O, *Letter from the California Department of Fish and Game***, includes a copy of the letter provided by the State regarding the decision not to open the South San Diego Bay Unit to hunting.

**Appendix P, *Public Comments to the Draft CCP/EIS and the Service's Responses***, presents the public and agency comments on the draft CCP/EIS and presents detailed responses prepared by the Service; these comments were considered in preparing the Final CCP/EIS.

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# *Chapter 1 – Introduction, Purpose and Need, and Issues*

## **1.1 Introduction**

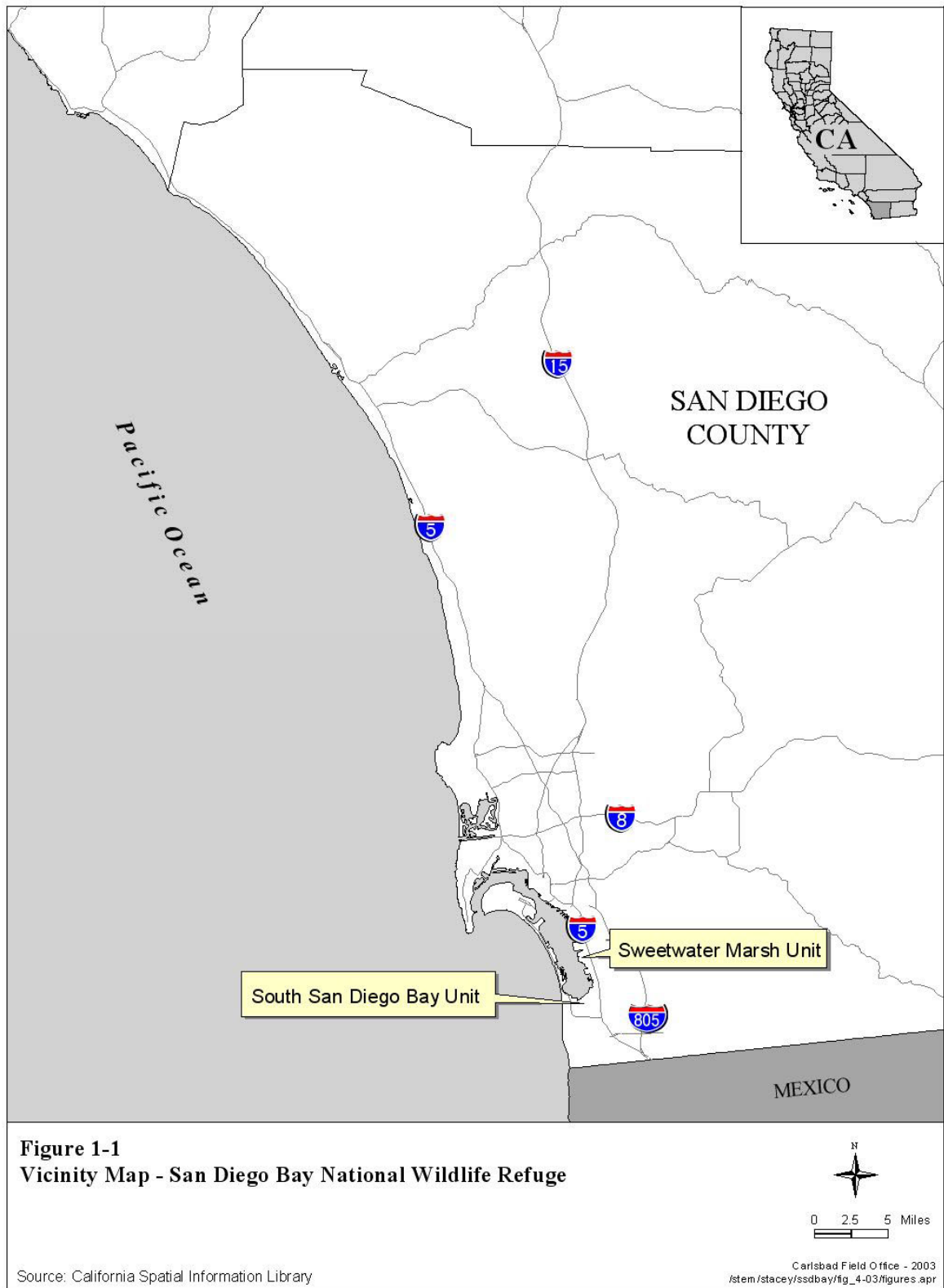
The San Diego Bay National Wildlife Refuge (NWR) is managed by the U.S. Fish and Wildlife Service (Service or USFWS) as part of the National Wildlife Refuge System (NWRS). Consisting of the Sweetwater Marsh and South San Diego Bay Units, the San Diego Bay NWR (Refuge) is located about ten miles north of the United States and Mexico border in San Diego County, California (Figure 1-1). The Refuge, which is situated at the south end of San Diego Bay (Figure 1-2), is surrounded by the urban communities of National City, Chula Vista, San Diego, Imperial Beach, and Coronado. The two Units within the Refuge were established to protect endangered and threatened species, and collectively encompass approximately 2,620 acres of land and water in and around San Diego Bay. Most of what remains of San Diego Bay's historical coastal salt marsh and intertidal mudflat habitat is preserved within these two Refuge Units.

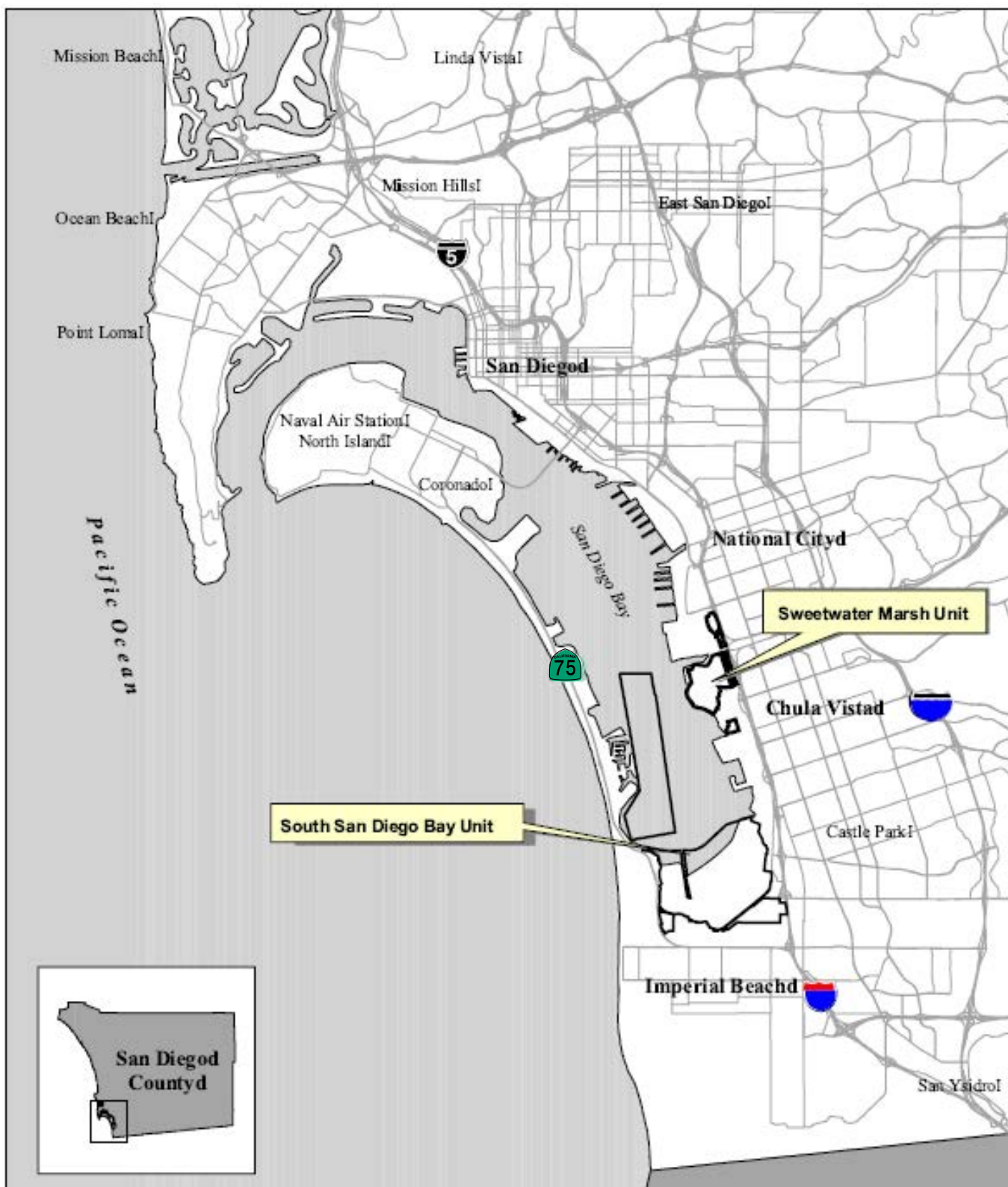
The 316-acre Sweetwater Marsh Unit is located along the eastern edge of San Diego Bay in an area that extends from just north of the 24<sup>th</sup> Street Flood Control Channel in National City to about G Street in Chula Vista (Figure 1-3). This Unit includes areas of tidally influenced salt marsh in Sweetwater Marsh, Paradise Marsh, and a small remnant marsh referred to as F&G Street Marsh. Also included are the upland habitats located on Gunpowder Point and the D Street Fill (a tideland area that was filled with dredge spoils in the late 1960s).

The South San Diego Bay Unit lies at the south end of San Diego Bay. The approved acquisition boundary includes approximately 3,940 acres (Figure 1-4); however, the Service currently only has management authority for approximately 2,300 acres within the approved Refuge boundary (Figure 1-5). Most of the remaining areas within the acquisition boundary are State Tidelands managed by the Unified Port of San Diego (Port). A small area near the northwest corner of Pond 11 is owned by the U.S. Navy (Navy). The lands and waters included within the current management boundary consist of portions of the open bay, active solar salt evaporation ponds (salt ponds), and the western end of the Otay River drainage basin (the Otay River floodplain).

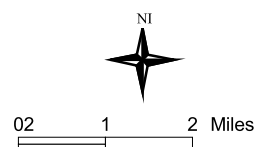
A Comprehensive Conservation Plan (CCP) is prepared pursuant to the National Wildlife Refuge System Administration Act of 1966 (NWRS Administration Act), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act) (Public Law 105-57) and an Environmental Impact Statement (EIS) is prepared in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA). The Improvement Act and Part 602 (National Wildlife Refuge System Planning) of the Fish and Wildlife Service Manual provides the directives and guidance for preparing CCPs and recommends that the draft CCP and draft EIS be incorporated into one document. This approach, which provides for the direct integration of the provisions of NEPA into the CCP process, complies with the requirement that Federal agencies integrate the NEPA process with other planning at the earliest possible time. When completed, the draft CCP/EIS is made available for public review and comment.

All comments received during public review and comment for the draft CCP/EIS are considered and addressed as appropriate in a Final CCP/EIS. Thirty days after the availability of the Final CCP/EIS is noticed in the Federal Register, a Record of Decision (ROD) can be signed. The Final





**Figure 1-2d**  
**Location of the San Diego Bay National Wildlife Refuge**

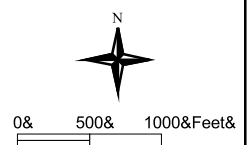






**Figure 1-3**  
**Aerial View of the Sweetwater Marsh Unit**

 Refuge boundary



Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)&

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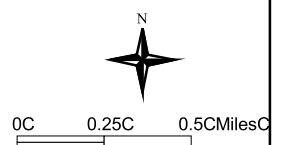




**Figure 1-4**  
**South San Diego Bay Unit Approved Acquisition Boundary**

 Approved Acquisition Boundary

Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)



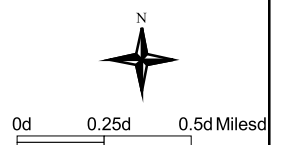
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**Figure 1-5**  
**South San Diego Bay Unit Current Refuge Boundary**

 South San Diego Bay Unit Existing Management Authority



Source: USFWS, Local Agency Partnership (2 ft imagery)d

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CCP is intended to guide the management of Refuge operations, habitat management, and visitor services for the next 15 years. Guidance within the Final CCP will be in the form of goals, objectives and strategies (Sections 2.2.5 and 2.3.5) and Compatibility Determinations (Appendix K). Some of the issues addressed in the Draft CCP/EIS were previously evaluated in the environmental assessment (EA) (USFWS 1999a) prepared for the South San Diego Bay Unit prior to establishing this Unit as part of the NWRs. The area analyzed in the EA (Figure 1-6) was larger than the area ultimately included within the approved acquisition boundary for the South San Diego Bay Unit. The NEPA analysis included in the EA was been incorporated, by reference, into the draft CCP/EIS.

The CCP/EIS identifies and evaluates alternative approaches for managing the two Refuge Units. It also describes the environmental consequences (direct, indirect, and cumulative) of implementing each alternative, or approach, as required by NEPA. The document is divided into eight chapters: Chapter 1 - Introduction, Purpose and Need, and Issues; Chapter 2 - Alternatives; Chapter 3 - Affected Environment; Chapter 4 - Environmental Consequences; Chapter 5 - Compliance, Consultation, and Coordination with Others; Chapter 6 - List of Preparers and Contributors; Chapter 7 - References Cited; and Chapter 8 - Index. Appendices provide supporting documentation for the CCP/EIS, including a glossary of terms, acronyms and abbreviations, a distribution list, CCP implementation, draft Compatibility Determinations, a description of the salt works operation, air quality calculations, hydrodynamic and brine modeling reports, wilderness review, and available step-down management plans.

The Service began the process of developing a CCP for this Refuge in June 2000. A Notice of Intent (NOI) was published in the Federal Register on June 23, 2000 (65 FR 39172) to initiate the planning process and solicit comments. A revised NOI was published on April 22, 2002 (67 FR 19583) to publicize the Service's intent to prepare an EIS in association with the CCP. On July 22, 2005, a Notice of Availability (NOA) was published in the Federal Register (70 FR 42359) announcing the availability of the draft CCP/EIS and soliciting comments. The comments and the Service's responses to the comments received are provided in Appendix P.

The development of issues and management alternatives took into consideration the public comments provided during the initial scoping period, as well as additional comments given during a yearlong public outreach program. Three alternative management approaches are evaluated for the Sweetwater Marsh Unit and four management alternatives are evaluated for the South San Diego Bay Unit. The alternatives include various proposals for habitat management, habitat restoration and/or enhancement, and public use.

The CCP/EIS is a programmatic document intended to analyze proposed actions on a conceptual level, except in those cases where sufficient information is available to provide project-specific analysis. Therefore, the extent of analysis provided for each restoration and/or public use proposal reflects the level of detail currently available for the specific proposal. The habitat restoration proposals analyzed in the CCP/EIS should be viewed as conceptual. It is during subsequent project level planning, referred to as "step-down" planning, that additional studies would be conducted, additional baseline data would be gathered, the appropriate project level NEPA documentation would be prepared, all necessary permits would be acquired, and final engineering and restoration planning would be conducted. Step-down planning would also include a public involvement component similar to that provided during the CCP process.

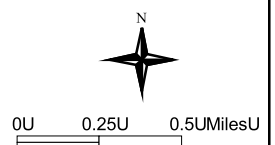




**Figure 1-6p**  
**Area Analyzed by the Environmental Assessment (EA) and p**  
**Land Protection Plan for the Proposed South San Diego Bay Unitp**

Note: The area analyzed in the EA was larger than the area included within the approved acquisition boundary

Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)U



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## 1.2 Proposed Action

The Service proposes to develop and implement a CCP for the San Diego Bay NWR that best achieves the purposes for which the Refuge was established, helps fulfill the mission of the NWRS, is consistent with sound fish and wildlife management, and ensures that the biological integrity, diversity, and environmental health of the NWRS are maintained. The Final CCP will include proposals for wildlife and habitat management, habitat enhancement and, where appropriate, habitat restoration, and public use. The Service examined a wide range of management alternatives for each Refuge Unit. Of these, Alternative C represents the Service preferred alternative for the Sweetwater Marsh Unit and Alternative D (incorporating Otay River Floodplain Restoration Option C2 and Salt Works Construction Phasing Scenario 2) represents the Service's preferred alternative for the South San Diego Bay Unit. Of the alternatives evaluated, these alternatives appear to best achieve the purpose, vision, and goals for the Refuge, while also appropriately addressing the major issues and relevant mandates identified for each Refuge Unit during the CCP process. Specific details regarding the preferred alternatives and the other alternatives that were evaluated during the CCP planning process are provided in Chapter 2.

## 1.3 Purpose and Need for the Comprehensive Conservation Plan

No formal management plan currently exists for either Refuge Unit; therefore, the development of a CCP is needed to provide guidance in conducting general refuge operations, wildlife and habitat management, habitat enhancement and restoration, and visitor services. The CCP is intended to ensure that management actions are consistent with the purposes for which the Refuge was established, the mandates of the NWRS, and the Refuge goals and objectives.

The purpose of the CCP is to describe the desired future conditions of the Sweetwater Marsh and South San Diego Bay Units over the next 15 years and provides guidance for achieving those conditions, whether it is through conservation or restoration of Refuge resources. This CCP:

- Sets a long term vision for the Refuge;
- Establishes management goals, objectives, and strategies for each Refuge Unit;
- Provides the Refuge with a 15-year management plan for the conservation of fish, wildlife, and plant resources and their related habitats;
- Defines compatible public uses;
- Develops a plan that, when fully implemented, will achieve Refuge purposes, help fulfill the mission of the System, and maintain and, where appropriate, restore ecological integrity;
- Communicates the Service's management priorities for the Refuge to the public; and
- Provides a basis for budget needs to support staffing, operations, maintenance, and capital improvements.

The development of this CCP is also required to fulfill legislative and contractual obligations of the Service. Its preparation is mandated by the NWRS Administration Act, as amended by the Improvement Act. The Improvement Act requires that a CCP be prepared for each refuge or related complex of refuges within 15 years of the law's enactment. This CCP will also satisfy a condition of the Public Agency Lease between the California State Lands Commission and the Service requiring the Service to provide the State Lands Commission with a plan for managing the leased tidelands included within the boundary of the South San Diego Bay Unit. The lease condition requires that the plan "detail the Lessee's management and development plans for the Refuge," as well as "include a public access component."

Finally, the CCP is required to fulfill the Service's obligation to prepare "a holistic habitat restoration plan" for a 1,035-acre portion of the existing salt works property, as described in a Cooperative Agreement between the Service and the Port, dated October 1998 and amended in March 1999.

Proposals for habitat enhancement and restoration are incorporated into several of the management alternatives presented in the CCP to implement the Service's policy for ensuring that the biological integrity, diversity and environmental health of the Refuge is maintained and, where appropriate, restored. Such proposals for enhancement and restoration are consistent with the objective included in the Land Protection Plan (*USFWS 1999*) for creating the South San Diego Bay Unit that states: "To provide the Service with the opportunity to manage, enhance, restore, and protect Refuge . . . areas for the benefit of federally listed and other trust species." The historical and ecological conditions on each Refuge Unit, as summarized below and described in detail in Section 3.4, establish the frame of reference to be used in maintaining and, where appropriate, restoring the biological integrity, diversity, and environmental health of the San Diego Bay NWR.

Prior to the 1900s, San Diego Bay was a fertile, shallow flat-bottomed bay surrounded by extensive mudflats and salt marshes (*USFWS 1999a*). Over the past hundred years, significant portions of the bay, particularly the northern two-thirds of the bay, have been dredged to support ship movement or filled to accommodate port development. At the southernmost end of the bay, much of the original salt marsh and intertidal mudflat habitat was diked to create solar evaporation ponds for the purpose of producing salt. Today, only 22 percent of San Diego Bay's historic salt marsh habitat and 8 percent of its original intertidal habitat remain intact (*U.S. Navy 2000*), and most of this remaining native habitat is located within the Refuge boundary. The coastal wetlands that remain not only provide habitat for several federally listed endangered and threatened species, but also represent a vital link in the Pacific Flyway (refer to Section 3.4.1.3). Portions of the salt pond complex located at the south end of the bay also represent important habitat for a variety of birds. Collectively, the open waters of the bay, tidal mudflats, salt marsh habitat, and salt ponds provide resting, feeding, and nesting areas for tens of thousands of migratory shorebirds, colonial seabirds, and wintering waterfowl.

The CCP is intended to provide the guidance necessary to ensure that these habitats receive the highest priority for protection and maintenance on the Refuge. It is also the goal of the CCP to provide opportunities to reverse the trend of historical wetland loss in San Diego Bay by incorporating proposals for restoring, where possible, the Refuge's historical native habitats, while also preserving those aspects of the existing salt pond complex that support a diversity and abundant array of avian species.

## **1.4 Required Permits and Approvals**

It will be necessary to obtain permits or approvals from other agencies to implement various actions in this CCP. The permits and approvals that could be required include:

- **U.S. Fish and Wildlife Service** – Project level internal Section 7 consultations, as appropriate under the authorities of the *Endangered Species Act (ESA)*, prior to the implementation of any actions proposed in the CCP that may affect federally listed endangered or threatened species. (A programmatic Biological Opinion has been prepared under the authorities of the *ESA* for the Final CCP.)

- **U.S. Army Corps of Engineers** – Clean Water Act 404 Permit and Rivers and Harbors Act Section 10 Permit for wetland restoration projects.
- **NOAA National Marine Fisheries Service (NMFS)** – Consultation with NMFS under the Magnuson-Stevens Fishery Conservation and Management Act for federal permitting and funding activities that could adversely affect Essential Fish Habitat.
- **U.S. Department of the Navy** – Approval to alter the current conditions in the northwestern corner of Pond 11, which is included within the Navy’s ownership.
- **California Coastal Commission** – Concurrence with the Service’s Consistency Determination for the CCP. (This involves a determination that the CCP is consistent to the maximum extent practicable with the California Coastal Management Program [Section 307 of the Coastal Zone Management Act]).
- **Regional Water Quality Control Board** – 401 Certification for wetland restoration projects and possibly a discharge permit for breaching the salt pond levees.
- **San Diego County Air Pollution Control Board** – Compliance with Rule 1501 of the Air Pollution Control District’s Rules and Regulations.
- **Caltrans, District 11** – Encroachment Permit, which would be required if any activities associated with the Refuge were to affect existing Interstate 5 right-of-way.
- **City of San Diego** – Encroachment Permit and/or other approvals, which would be required if restoration is proposed on properties owned by the City of San Diego.

## **1.5 Legal and Policy Guidance**

### **1.5.1 U.S. Fish and Wildlife Service**

The San Diego Bay NWR, consisting of the Sweetwater Marsh and South San Diego Bay Units, are managed by the Service as part of the larger San Diego National Wildlife Refuge Complex. The Service is the primary Federal agency responsible for conserving and enhancing the nation’s fish and wildlife populations and their habitats. Although the Service shares this responsibility with other Federal, State, tribal, local, and private entities, it is the Service that has specific responsibility for migratory birds, threatened and endangered species, and certain anadromous fish and marine mammals. The Service also has similar trust responsibilities for the lands and waters it administers to support the conservation and enhancement of fish and wildlife.

### **1.5.2 National Wildlife Refuge System**

The mission of the National Wildlife Refuge System (NWRS) is:

*“To administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (16 USC 668dd et seq.).*

Florida’s Pelican Island, which was the first refuge in the NWRS, was established in 1903 by President Theodore Roosevelt. Since that time, the NWRS has grown to more than 96 million acres. It includes more than 545 refuges, at least one in every state and many U.S. territories, and over 3,000 Waterfowl Production Areas. The NWRS is the largest collection of lands and waters specifically managed for fish and wildlife conservation in the nation. The needs of wildlife and their habitats come first on refuges, in contrast to other public lands managed for multiple uses.

The administration, management, and growth of the NWRS are guided by the following goals (*draft Mission, Goals, and Purposes Policy, January 16, 2001*):

- Fulfill our statutory duty to achieve Refuge purpose(s) and further the System mission.

- Conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered.
- Perpetuate migratory bird, interjurisdictional fish, and marine mammal populations.
- Conserve a diversity of fish, wildlife, and plants.
- Conserve and restore, where appropriate, representative ecosystems of the United States, including the ecological processes characteristic of those ecosystems.
- Foster understanding and instill appreciation of fish, wildlife, and plants, and their conservation, by providing the public with safe, high-quality, and compatible wildlife-dependent public use. Such use includes hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

Operation and management of National Wildlife Refuges are guided by the mission and goals established for the NWRS in the NWRS Administration Act of 1966, as amended, and the designated purpose(s) for which each refuge was established. Refuge management is also influenced by other laws, treaties and executive orders pertaining to the conservation and protection of natural and cultural resources, such as Executive Order 12996 (*Management and General Public Use of the National Wildlife Refuge System*), the Refuge Recreation Act of 1962, the Endangered Species Act of 1975, Executive Order 13186 (*Responsibilities of Federal Agencies to Protect Migratory Birds*), and the Fish and Wildlife Act of 1956 (refer to Chapter 5 for additional information about these laws and orders).

### **1.5.2.1 National Wildlife Refuge System Improvement Act**

The Improvement Act, which amends the NWRS Administration Act of 1966, serves as an “organic” act for the NWRS and provides comprehensive legislation describing how the NWRS should be managed and used by the public. The Improvement Act establishes a strong and singular wildlife conservation mission for the Refuge System; requires that the Secretary of the Interior maintain the biological integrity, diversity and environmental health of the Refuge System; requires that public use of a refuge may be allowed only where the use is compatible with the mission of the System and purpose of the individual refuge; and sets forth a standard for determining whether such uses are compatible. It also recognizes that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation, when determined to be compatible, are legitimate and appropriate public uses of the Refuge System.

The Improvement Act also includes policies and procedures through which individual refuges are to be managed to fulfill the mission of the System for the long-term benefit of the American people. One of these procedures is to develop a CCP for each refuge within the System by 2012. The CCP should identify and describe the purposes of the refuge; the fish, wildlife and plant populations, their habitats, and the archaeological and cultural values found on the refuge; significant problems that may adversely affect wildlife populations and habitats and ways to correct or mitigate those problems; areas suitable for administrative sites or visitor facilities; and opportunities for fish- and wildlife-dependent recreation. An important aspect of the Improvement Act is to ensure the opportunity for active public involvement in the preparation and revision of CCPs. It is Service policy that CCPs be developed in an open public process and that public input be sought and encouraged throughout the process.

### **Compatibility Policy**

Lands within the NWRS are different from other multiple use public lands in that they are closed to all public uses unless specifically and legally opened. The Improvement Act states “. . . the Secretary shall not initiate or permit a new use of a Refuge or expand,



renew, or extend an existing use of a Refuge, unless the Secretary has determined that the use is a compatible use and that the use is not inconsistent with public safety.” The Improvement Act also states that “. . . compatible wildlife-dependent recreational uses [hunting, fishing, wildlife observation and photography, or environmental education and interpretation] are the priority general public uses of the System and shall receive priority consideration in Refuge planning and management.”

In accordance with the Improvement Act, the Service has adopted a Compatibility Policy (603 FW 2) that includes guidelines for determining if a use proposed on a National Wildlife Refuge is compatible with the purposes for which the refuge was established. A compatible use is defined in the policy as a proposed or existing wildlife-dependent recreational use or any other use of a National Wildlife Refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the NWRS mission or the purposes of the Refuge. The Policy also includes procedures for documentation and periodic review of existing refuge uses.

When a determination is made as to whether a proposed use is compatible or not, this determination is provided in writing and is referred to as a compatibility determination. An opportunity for public review and comment is required for all compatibility determinations. For compatibility determinations prepared concurrently with a CCP or step-down management plan, the opportunity for public review and comment is provided during the public review period for the draft plan and associated NEPA document. The compatibility determinations prepared in association with this CCP/EIS are provided in Appendix K.

### **Biological Integrity, Diversity and Environmental Health Policy**

The Improvement Act states that "In administering the System, the Secretary shall . . . ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans . . ." To implement this directive, the Service has issued the Biological Integrity, Diversity and Environmental Health Policy (601 FW 3), which provides policy for maintaining and restoring, where appropriate, the biological integrity, diversity, and environmental health of the NWRS. The policy is an additional directive for Refuge Managers to follow while achieving refuge purposes and the NWRS mission. The policy provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges and associated ecosystems. Further, it provides a refuge evaluation process that can assist refuge managers in developing management direction that when implemented would prevent further degradation of environmental conditions and allow for the restoration of lost or severely degraded resources, where appropriate.

When evaluating the appropriate management direction for refuges, Refuge Managers will use sound professional judgment to determine their refuge's contribution to biological integrity, diversity, and environmental health at multiple landscape scales. Sound professional judgment incorporates field experience, an understanding of the refuge's role within an ecosystem, and the knowledge of refuge resources, applicable laws, and best available science, including consultation with others both inside and outside of the Service.

The priority public uses of the NWRS are not in conflict with this policy when they have been determined to be compatible. The directives of this policy do not envision or necessitate the exclusion of visitors or the elimination of visitor use structures from refuges; however, maintenance and/or restoration of biological integrity, diversity, and



environmental health may require spatial or temporal zoning of visitor use programs and associated infrastructures. General success in maintaining or restoring biological integrity, diversity, and environmental health will produce higher quality opportunities for providing wildlife-dependent recreational uses.

## **1.6 History of Refuge Establishment and Purpose**

### **1.6.1 Introduction**

The Service's interest in acquiring coastal wetlands along the southern coast of San Diego County began in the early 1970s. Areas considered for acquisition included the properties in and around Sweetwater Marsh, the salt ponds in south San Diego Bay, and the Tijuana Slough. In 1972, the Service's Division of Realty prepared a Reconnaissance Appraisal Report to estimate the cost of acquiring these parcels and establishing a "South San Diego Wildlife Preserve." These areas were targeted for acquisition because they supported habitat essential to the protection and recovery of several federally listed endangered species, including the light-footed clapper rail (*Rallus longirostris levipes*) and California least tern (*Sternula antillarum*).

By the late 1970s, 90 percent of the light-footed clapper rail habitat in south San Diego Bay had been eliminated. To complicate matters, two significant projects were being contemplated for the south San Diego Bay that would likely further erode the amount of habitat available to support the rail and other federally listed endangered species. One proposal involved a combined flood control/highway project to be constructed along the Sweetwater River. The other project was the possible construction of a second entrance into San Diego Bay that would cut across the Silver Strand just north of Crown Cove.

A substantial portion of the bay's intertidal wetlands had been filled or dredged by the 1970s to accommodate various port developments. The new proposals for additional filling that were under review in the South Bay at this time would have resulted in even greater losses of already scarce habitat. Consequently, in 1979 the Service prepared an environmental assessment (EA)/Acquisition Ascertainment Report (AAR) to review impacts related to the acquisition of approximately 2,700 acres of South Bay habitat in order to conserve endangered wildlife. The areas covered by the EA/AAR included those lands within and surrounding the present day boundary of the Sweetwater Marsh Unit, the southern end of the bay from J Street on the east and the southern end of Emory Cove on the west, and all of the salt evaporation ponds, including Pond 20A (Figure 1-7). The EA/AAR proposed incorporating these lands into a National Wildlife Refuge or State Ecological Reserve under the authority of the Endangered Species Act of 1973, as amended (87 Stat. 884), and previous land acquisition legislation authorized by the Secretary of the Interior to conserve endangered wildlife by implementing a land acquisition program (45 Stat. 1222) (*USFWS 1979*).

Although the Service completed the EA/AAR in 1979 and determined that the proposed acquisition was not a major Federal action that would significantly affect the quality of the human environment, it would be almost ten years before the first of two areas within the South Bay would be incorporated into the NRWS. The establishment history for each of these Refuge Units is described below.

### **1.6.2 Sweetwater Marsh Unit – Acquisition History and Establishment**

The Sweetwater Marsh NWR (now referred to as the Sweetwater Marsh Unit) was established in 1988 after several years of contentious litigation over a combined freeway/flood control project and a proposed bayfront development in the City of Chula Vista. The circumstances and events leading



to the establishment of this Refuge illustrate the gradual change in attitude toward the environment that occurred in both the public and private sector between the 1960s and the 1980s. In the mid 1960s, the California Department of Transportation (Caltrans) used funding from the Federal Highway Administration and began developing major highway improvement plans for Interstate 5 (I-5) and State Route 54 (SR 54) in the vicinity of the Sweetwater River. At about the same time, the U.S. Army Corps of Engineers (ACOE) was developing plans to channelize the Sweetwater River. Channelization was to involve the construction of a 3.4-mile-long, trapezoidal channel that would divert river flows from the river's historic course through Sweetwater Marsh into what is now known as the 24<sup>th</sup> Street flood control channel. These two projects were combined in the late 1970s to be processed as a single Federal project called the Sweetwater River Flood Control Channel/State Highway Route 54 Interstate 5 project (the combined federal project).

Also in the 1970s, the Service began an evaluation of the various habitats in South San Diego Bay, including the habitats within the Sweetwater River Wetlands Complex. This Complex consisted of the Sweetwater River in its historic configuration, which flowed through Sweetwater Marsh, the tidal marsh, high marsh, and salt pan habitats in Sweetwater Marsh, Paradise Marsh, E Street Marsh, F&G Street Marsh, and Vener Pond, and the mudflats located to the west of the D Street Fill and Gunpowder Point. The importance of preserving the habitats within this marsh complex was described in a Service document prepared in 1979 entitled: "*Proposed Land Acquisition in South San Diego Bay for Endangered Species Light-footed Clapper Rail (*Rallus longirostris levipes*) and California Least Tern (*Sterna albifrons browni*).*" [Note: The scientific nomenclature for California least tern at that time was *Sterna albifrons browni*, it has since changed to *Sternula antillarum* (Banks et al. 2006).]

The Service initiated consultation with the ACOE and the Federal Highway Administration on their prospective projects because of its interest in the Sweetwater River Wetlands Complex and its authority under the Fish and Wildlife Coordination Act and later, the Endangered Species Act. It would take almost ten years from the time consultation began for the project proponents to agree to provide mitigation for impacts to endangered species from the combined federal project. The Service first requested that the ACOE consider endangered species issues in 1971. The Endangered Species Act of 1973 was subsequently enacted, further elevating the Service's involvement in the review of potential impacts from the combined project on endangered species.

Informal discussions related to Section 7 of the Endangered Species Act began in about 1974 and continued until 1977, when formal consultation began with both ACOE and the Federal Highway Administration (working with Caltrans). The Service issued the first Biological Opinion for the combined federal project in 1978, which concluded that the project's impacts would likely jeopardize the continued existence of the federally listed endangered light-footed clapper rail and California least tern. The majority of these impacts were attributed to habitat destruction.

The Service issued a second Biological Opinion in 1979 that included modifications to the project design to avoid jeopardy to the listed species. The most critical of the mitigation measures advocated by the Service was the acquisition and preservation of the 188-acre Sweetwater River Wetlands Complex. Forty-four acres of the proposed acquisition were required to mitigate direct wetland losses and the additional 144 acres were to be provided to offset adverse effects to the clapper rail and least tern, as well as to salt marsh bird's beak (*Cordylanthus maritimus maritimus*), a federally-listed endangered plant species. (It should be noted that a survey of the proposed acquisition revealed that the area actually included only 178 acres.)

In 1981 the Federal project proponents presented a modified project with eleven features, including acquisition and preservation of the privately-held Sweetwater River Wetlands Complex.

The Service reviewed the modified project and concluded that the proposed measures were “the minimally acceptable loss compensation requirements needed to protect and maintain habitat and endangered species” (*USFWS 1988*). With the Service’s concurrence, the ACOE agreed to take the lead on acquisition procedures, but soon found that obtaining Congressional approval to purchase or condemn the land would take considerable time. To avoid these delays, the County of San Diego (County), which was the combined project’s local sponsor, offered to obtain the property and transfer it to an ACOE-designated state or Federal agency. In December 1984 the County and the ACOE signed a contract, referred to as a “Section 221 Agreement,” in which the County agreed to acquire and transfer the lands by December 1985. The County failed to acquire the land and instead, requested extensions from the ACOE, which were denied. In the meantime, the combined federal project was proceeding without any acquisition of mitigation land.

Also during this time, the City of Chula Vista was developing a Bayfront Plan for the area in and around the Sweetwater River Wetlands Complex. After initially denying Chula Vista’s Local Coastal Program (LCP) in 1981, the California Coastal Commission ultimately approved the LCP in September 1984. The plan, as approved, included a proposal for a 440-room hotel and convention center on Gunpowder Point, high-rise residential buildings on D Street Fill, and the construction of several roads through the Sweetwater River Wetland Complex to provide access to these developments. The Service objected to the certification of the LCP due to the endangered species impacts that would occur as a result of project implementation. Later that year, the Sierra Club filed a lawsuit in State court challenging the Coastal Commission’s approval of the LCP, claiming that approval of the plans for Gunpowder Point and D Street Fill violated the California Coastal Act.

In August 1986, the County attempted to fulfill its obligation under the Section 221 Agreement and entered into an escrow agreement with the City of Chula Vista and the Santa Fe Land Improvement Company (the owner of the property described as the Sweetwater River Wetland Complex). The escrow agreement made transfer of the land to the County contingent upon ACOE issuing several permits needed to develop Gunpowder Point and D Street Fill. The same agreement also reserved seven easements in the proposed mitigation lands for the Santa Fe Land Improvement Company. These conditions and easements were included because the Santa Fe Land Improvement Company contended that transfer of the land for preservation without the easements and guarantees for approval for certain permits would prohibit development of Gunpowder Point and the D Street Fill, as approved in the LCP for this area. Both the ACOE and the Service objected to the inclusion of these easements and other conditions of escrow contending that they would reduce or eliminate the mitigation land’s value as habitat for the endangered species.

In August 1986 the Service formally requested that the ACOE reinitiate Section 7 consultation on the combined federal project as a result of the County’s failure to transfer the mitigation lands; the Coastal Commission’s approval of Chula Vista’s LCP; and a pending proposal to construct an access road through the proposed mitigation lands. The ACOE was still proceeding with construction, despite the unfulfilled obligation to acquire mitigation lands and responded to the Service’s request by refusing to reinitiate consultation.

On September 17, 1986, the Sierra Club and League for Coastal Protection filed a complaint in Federal Court under the citizen suit provision of the Endangered Species Act. The complaint asserted that the ACOE had violated the Act by refusing to reinitiate consultation with the Service. The Sierra Club also sought an injunction prohibiting any further construction on the combined project until the ACOE reinitiated consultation with the Service under Section 7 of the Endangered Species Act and the County transferred the mitigation lands in accordance with the

Section 221 Agreement. A hearing was held in United States District Court to consider the motions; however the court denied the Sierra Club's request. The lower court's decision was appealed to the United States Court of Appeals for the Ninth Circuit. In May 1987, the District Court reversed the lower court's decision, finding that the Sierra Club was entitled to an injunction against all work on the project and that the ACOE had violated the Endangered Species Act by refusing to reinstate consultation with the Service. On July 13, 1987, the District Court issued a permanent injunction, stopping all work on the combined federal project until the ACOE reinstated consultation with the Service. Following that decision, the ACOE requested that consultation with the Service regarding the combined federal project be reinstated.

The Service issued a biological opinion in March 1988, which concluded that the combined federal project would likely jeopardize the continued existence of the California least tern, light-footed clapper rail, and salt marsh bird's beak. It further stated that this project, when combined with the reasonably foreseeable non-Federal developments anticipated in the adopted LCP, would appreciably reduce the likelihood for survival and recovery of these species. The Service proposed what was referred to as a reasonable and prudent alternative that outlined a number of features; these included a request to not only acquire and convey to the United States the 178 acres previously required for mitigation (with all objectionable easements excluded), but also the acquisition and conveyance of Gunpowder Point, D Street Fill, and the F&G Street Marsh. These additional lands, subsequently referred to as Mitigation Leasehold Overlays, would be conveyed subject to a reserved lease for 20 years that would allow the Santa Fe Improvement Company to perform wildlife habitat enhancement on these areas for future mitigation credits. The Service further stated that the conveyed lands were to be managed in accordance with the NWRS Administration Act, the Refuge Recreation Act, the Endangered Species Act, and other applicable Federal laws.

Following several months of negotiations, a settlement agreement was drafted by the Federal defendants, the Sierra Club and League of Coastal Protection, Caltrans, the County of San Diego, and the owner of the proposed mitigation lands, Santa Fe Land Improvement Company. On May 13, 1988, the court approved a Stipulated Settlement Agreement, which was to become effective upon close of escrow. Escrow closed on August 12, 1988 and the Federal government received 35.5 acres from the State of California (specifically Caltrans) and 280.3 acres from the Santa Fe Land Improvement Company. Upon the transfer of the 315.8 acres to the Service, the Sweetwater River Wetlands Complex, as it had been called, was officially incorporated into the NWRS.

From 1988 to 2004, the Refuge was referred to as the Sweetwater Marsh NWR. In 2004, this Refuge, along with the South San Diego Bay Unit, was incorporated into the San Diego Bay NWR. The refuge lands around Sweetwater Marsh are now referred to as the Sweetwater Marsh Unit of the San Diego Bay NWR.

### **1.6.3 South San Diego Bay Unit – Acquisition History and Establishment**

As discussed previously, the Service completed a study in 1972 that identified potential parcels for inclusion in a South San Diego Wildlife Preserve. However, it was not until about 1978 that a grass-roots effort was initiated to build support for establishing a national wildlife refuge in South San Diego Bay. By 1987 a nonprofit group, Friends of South Bay Wildlife, had been formed to work with concerned organizations, individuals, local communities, and interested government agencies to develop a proposal for a sustainable South Bay that included the creation of a national wildlife refuge. The group's proposal was presented in "*A Comprehensive Proposal for the Enhancement, Conservation and Development of South San Diego Bay*," published in September 1995. The goals of this proposal were "to protect and enhance South Bay's habitats for threatened

and endangered species, both migratory and resident wildlife, and the incorporation of local community concerns in order to foster a mutually beneficial development strategy.”

In the early 1990s, prior to the Friends’ proposal, the Service began revisiting the idea of establishing a refuge unit in the South Bay. One of the first steps in this process was implemented by the Service’s Coastal Program, which assessed and documented the significant bird use in the South Bay and at the salt works. This information, which was published in three reports (*Stadtlander and Konecny 1994 and USFWS 1995a, 1995b*), was essential to understanding the importance of this area to migrating shorebirds and wintering waterfowl, as well as nesting seabirds.

Based on this information and public comments provided at a series of public meetings, the Service proposed several Refuge boundary alternatives and began the preparation of a Land Protection Plan (LPP) (*USFWS 1999a*). The LPP outlined the habitat protection methods the Service would use for the proposed South San Diego Bay Unit. Also presented within the LPP are the three objectives for creating the South San Diego Bay Unit, including:

- *To provide the Service with authority to acquire or otherwise protect wildlife habitat as part of the National Wildlife Refuge System . . .*
- *To provide the Service with the opportunity to manage, enhance, restore, and protect Refuge . . . areas for the benefit of federally listed and other trust species . . .*
- *To provide opportunity for the Service to develop compatible wildlife-dependent recreational activities in partnership with local communities.*

An EA (*USFWS 1999a*) was prepared in association with the LPP to evaluate the effects of establishing an approved Refuge boundary for four boundary alternatives. The study area for the proposed South San Diego Bay Unit included approximately 5,000 acres, stretching westward from the 24<sup>th</sup> Street Channel to just north of Crown Cove, southward around the salt ponds, and then northward along the Bay’s edge (refer to Figure 1-6).

In 1993, the Naval Training Center, San Diego (NTC), located adjacent to the San Diego International Airport, was identified for closure during the Base Closure and Realignment Commission (BRAC) process of 1993. Presidential approval of the 1993 BRAC closure list slated NTC for closure and transfer of property by 1999, in accordance with the Base Closure and Realignment Act of 1990. During the base closure discussions, a 25-acre site on NTC was identified for protection as a California least tern nesting site. This resulted in the need to either protect the site in place or find an acceptable replacement site that would support least tern nesting. Following extensive negotiations, an agreement was reached among the U.S. Navy, the Service, and the Port that would provide alternative nesting habitat for the tern.

The terms and conditions of this agreement, which are described in the Biological Opinion prepared by the Service on October 13, 1998, include: the NTC least tern nesting site or a replacement nesting site must be placed under federal protection in the National Wildlife Refuge System; annual least tern and snowy plover monitoring and predator management shall be provided at the salt works in perpetuity; least tern habitat enhancement measures, including expansion of tern foraging habitat and enhancement of nesting substrate within the salt works shall be implemented; overall restoration plans for the salt works shall include new least tern nesting area; public access and human disturbance shall be controlled at the salt works during the nesting season; future restoration of the salt ponds shall avoid and minimize adverse effects to

least terns and snowy plovers; and habitat and management needs for least terns and snowy plovers shall be addressed in the CCP prepared for the South San Diego Bay Unit.

On October 16, 1998, the Service and the Port signed a Cooperative Agreement to protect and enhance nesting and foraging habitats for the endangered California least tern at the salt works in South San Diego Bay in accordance with the terms and conditions outlined in the Biological Opinion. This agreement, which was amended in March 1999 to clarify the terms and obligations of the agreement, required that in exchange for the release of a least tern nesting habitat conservation easement on the 25-acre NTC least tern site, the Port would: 1) acquire fee title most of the salt ponds owned by the Western Salt Company and then transfer the ownership of approximately 720 acres to the California State Lands Commission; 2) acquire leasehold interest from Western Salt on an additional 612 acres and transfer that interest to the State Lands Commission; 3) work with the State Lands Commission to effect transfer of those portions of the acquired property and leasehold interest to the Service that are within the acquisition boundary of the proposed South San Diego Bay Unit; and 4) commit \$900,000 in mitigation and in-kind services for restoration and management within the acquired lands. It was through the execution of this Cooperative Agreement that a large portion of South San Diego Bay was ultimately incorporated into the South San Diego Bay Unit.

In January 1999, after considering the analysis provided in the EA and factoring in the comments received during the public comment period, the Service selected a preferred Refuge boundary and signed a Finding of No Significant Impact for the proposed South San Diego Bay Unit. This action established an approved acquisition boundary for the South San Diego Bay Unit that encompassed 3,940 acres of land and water in the south bay. Following this action, the California State Lands Commission approved a \$20.5 million expenditure of Public Trust funds by the Port to acquire 722 acres of salt ponds owned by Western Salt Company. The lands were transferred from the Port to the State Lands Commission in accordance with State law, which requires lands acquired using public trust revenues to be retained by the trustee as an asset for the people of the State. In turn, the State Lands Commission leased these lands, as well as approximately 1,500 additional acres of State tidelands, to the Service for a period of 49 years, with an automatic extension to 66 years, to include in and be managed as a National Wildlife Refuge. The Refuge Unit was officially established on June 16, 1999, the day the lease for the 2,209 acres of State Tidelands was approved.

On January 27, 2000, the Service acquired an additional 91 acres of vacant land located within the Otay River floodplain (refer to Figure 1-4). This acquisition was the result of a donation from the Southwest Wetlands Interpretive Association (SWIA), a non-profit organization dedicated to the preservation, restoration, and acquisition of wetlands. SWIA obtained the funds needed to acquire this property from the California Coastal Conservancy. The Coastal Conservancy identified the acquisition area as a critical link between the coastal marine environment of South San Diego Bay and the riparian habitat of the Otay River Valley and subsequently authorized the disbursement of funds to SWIA for the property acquisition. Following acquisition, SWIA conveyed fee title of the property to the Service. With this acquisition, the total acreage within the approved acquisition boundary being managed as part of the National Wildlife Refuge System was increased to 2,300 acres.

On July 13, 2004, the acreage in the South San Diego Bay Unit of the San Diego NWR was added to the Sweetwater Marsh NWR and both areas were renamed the "San Diego Bay NWR." The San Diego Bay NWR is now made up of the South San Diego Bay Unit and the Sweetwater Marsh Unit. This change was made to streamline management and facilitate public understanding and recognition of the two Refuge areas.

#### **1.6.4 Refuge Purposes for the San Diego Bay NWR**

The refuge purpose refers to the justification for the establishment of a Refuge within the NWRS as a place owned by the American people and cared for on their behalf. The purposes of the refuge are defined by the Improvement Act as the “purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit” (Director’s Order No. 132).

In combining and renaming the two Refuge areas in San Diego Bay, the original purposes for establishing these two Units were also combined. The consideration of these purposes is essential to the development of Refuge goals and objectives and in authorizing public uses on the Refuge, which must be shown to be appropriate and compatible with the purpose(s) of the Refuge and the mission of the NWRS before they are allowed. The Refuge purposes for the San Diego Bay NWR include:

“to protect, manage, and restore habitats for federally listed endangered and threatened species and migratory birds, and to maintain and enhance the biological diversity of native plants and animals” 16 U.S.C. § 1531-1543 (Endangered Species Act of 1973, as amended) and 70 Stat. 1119 (Fish and Wildlife Act of 1956, as amended);

... for the development, advancement, management, conservation, and protection of fish and wildlife resources ...” 16 U.S.C. § 742f(a)(4) “... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ...” 16 U.S.C. § 742f(b)(1) (Fish and Wildlife Act of 1956); and

... shall be administered by him [Secretary of the Interior] directly or in accordance with cooperative agreements ... and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon, ...” 16 U.S.C. § 664 (Fish and Wildlife Coordination Act).”

### **1.7 Management Direction and History**

#### **1.7.1 Introduction**

The San Diego Bay NWR currently operates without an official management plan. In addition, no step-down plans have been approved to guide specific management activities. Management direction is currently influenced by laws, treaties, and executive orders related to the conservation and protection of natural and cultural resources; applicable Service recovery plans; and programs and recommendations associated with ongoing migratory bird planning efforts. The most important orders and laws affecting the operation and management of refuges include Executive Orders 12996 (Management and General Public Use of the National Wildlife Refuge System) and 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds), the NWRS Administration Act, as amended, the Refuge Recreation Act, the Endangered Species Act, and the Fish and Wildlife Act of 1956. Consistency with these and other orders and regulations is described in greater detail in Chapter 5.

The NWRS Administration Act, as amended, establishes a unifying mission for the Refuge System, a process for determining compatible uses of Refuges, and a requirement for preparing comprehensive conservation plans. First and foremost, this Act states that the mission of the NWRS should be focused singularly on wildlife conservation.



The Refuge Recreation Act requires that any recreational use on areas of the NWRS be “compatible” with the primary purpose(s) for which the area was acquired or established. It also requires that sufficient funding be available for the development, operation, and maintenance of recreational uses that are not directly related to the area’s primary purpose(s).

The Endangered Species Act (ESA), as amended, does not specifically address the Refuge System, but does directly affect management activities within the NWRS. The Act directs Federal agencies to ensure that actions they carry out, authorize, or fund do not jeopardize endangered species or their critical habitat. The ESA also provides authority to the Service for land acquisition.

The Fish and Wildlife Act of 1956 establishes a comprehensive national fish, shellfish, and wildlife resources policy with emphasis on the commercial fishing industry. It recognizes the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment and directs those administering the Act to maintain and increase public opportunities for recreational use of fish and wildlife resources.

### **1.7.2 Past Management Activities on Sweetwater Marsh Unit**

For the first few years after establishing the Refuge, management efforts focused on developing and enhancing working relationships with the City of Chula Vista and other concerned parties; overseeing the design and implementation of numerous long range mitigation programs required by the Stipulated Settlement Agreement approved by the District Court in May 1988; and developing routine Refuge programs, such as law enforcement, resource monitoring, contaminant assessment, and educational activities (*USFWS 1988*).

Many of these activities continue to be implemented today. Primary management activities include monitoring California least tern and western snowy plover (*Charadrius alexandrinus nivosus*) nesting at D Street Fill, annual breeding call surveys of the Refuge’s light-footed clapper rail population, monitoring species covered by the City of San Diego’s Multiple Species Conservation Program (MSCP), predator management, contaminants assessment, and enforcement of Refuge regulations related to public access. The Service jointly shares management responsibilities with the Port for pre-nesting season site preparation at the D Street Fill, which involves removing non-native weedy vegetation from the western portion of the fill area. Another management action previously implemented by the Service was the construction of artificial nesting platforms within the marsh to improve fledging success for the light-footed clapper rail.

For the past several years, a captive propagation protocol development program for the light-footed clapper rail has been implemented on the Refuge. Program development has involved a number of partners, including Refuge staff, the Carlsbad Fish and Wildlife Office, Division of Ecological Services, the Zoological Society of San Diego, SeaWorld San Diego, the Port, U.S. Navy, and experts, such as Dr. Richard Zembal. This program is an outgrowth of previous work conducted in the field in an attempt to enhance demographic and possibly genetic variability within the remaining sub-populations of light-footed clapper rails; it has lead to the successful hatching of rails in 2001, 2002, 2003, and 2004. Several captive bred birds were released at Sweetwater Marsh NWR in 2002. Additional releases into appropriate marshes occurred in 2003 and 2004. In January 2003, the program included four pairs of rails, with three pairs housed at the Chula Vista Nature Center and one at SeaWorld. The program is evaluating a variety of issues including identification of additional release locations, monitoring following release, genetic fingerprinting of captive and released birds, and concerns related to transmissible diseases.

Funding has been a major limiting factor for this program. Funding sources exist that, if tapped, could allow research to be expanded to include radio-telemetry tracking of released birds, genetic

“fingerprinting” of captive and wild birds, and other applied research activities that would benefit the recovery efforts for this species.

Periodic control of invasive plant species is also conducted on the Refuge. A variety of control methods are utilized, including manual, mechanical, and chemical control. The method chosen to control an infested area is based on the size of the infestation, the site location and proximity to sensitive resources, and the species being controlled. The primary method for controlling invasive plants on this Refuge is manual control of the invasive plants that grow along the existing trail system on Gunpowder Point. Mechanical removal is conducted on the D Street Fill, where large areas of weedy species tend to germinate during the rainy season. When chemical application is determined to be the most appropriate control method, a glyphosate based product, such as RoundUp or Rodeo, is used. A glyphosate-plus-surfactant product is used in upland areas, while a glyphosate product containing no surfactant is used in wet areas. The Refuge receives annual approval to apply specific chemical products through the Pesticide Use Proposal process. This process describes the proposed uses for the chemicals, where they might be applied, rates of application, and what steps will be taken to protect wetlands, endangered and threatened species, and other trust resources on the Refuge. The refuge manager has the authority to allow use of glyphosate on the Refuge without Regional approval; however, for most other pesticides and herbicides, an individual Refuge must have approval from the Regional Integrated Pest Management Coordinator prior to use. All approved chemical applications are performed by Refuge staff or contractors with a Qualified Applicator's License.

As described Section 1.6.2, the court action that led to establishing the Sweetwater Marsh Unit provided the underlying landowner (Santa Fe Land Improvement Company, a California Corporation), or its successors in interest, with certain leasehold interests over specific portions of Gunpowder Point, D Street Fill and F&G Street Marsh. These leasehold interests permit the leaseholder to obtain or sell mitigation credits for approved habitat enhancement projects that are implemented on the various leaseholds (refer to Section 2.2.2.1 for additional information on this subject). To date, two enhancement projects have been implemented on one of the mitigation leasehold overlays. One enhancement project involved a 10-acre parcel on the D Street Fill that was set aside for least tern nesting habitat as mitigation for impacts from the construction of a hotel on a historic least tern nesting site in the vicinity of Coronado Cays. The other involved the creation of 1.3 acres of shallow subtidal habitat near the eastern end of D Street Fill. This habitat was created to mitigate the loss of San Diego Bay surface water and bay bottom habitat related to activities at the National Steel and Shipbuilding Company shipyard.

Approximately 83 acres of the Refuge continue to be included in mitigation leasehold overlays. Since they were established, the Service has managed those portions of the leasehold overlays that have not yet been used for mitigation. These areas are managed for various purposes; for example, the western end of Gunpowder Point located near the Chula Vista Nature Center is managed as a public use area to facilitate environmental education and interpretation, wildlife observation, and wildlife photography. Portions of the D Street Fill are currently managed as nesting habitat for terns and plovers.

According to the provisions of the Stipulated Settlement, the leaseholder may use, in whole or in part, any of the specified lands for wildlife habitat enhancement projects, upon approval of the Service. In addition, the leaseholder may assign its rights under this lease, in whole or in part, to any third party for the purpose of carrying out such projects. The terms and agreements related to these leaseholds are described in Exhibit 4 of the Agreement and Escrow Instructions that were approved as part of the Stipulated Settlement, as well as in a Memorandum of Understanding (MOU), dated March 27, 1998, between the Service and Chula Vista Capital, the current

leaseholder. This leasehold interest expires in 2008 unless, per the provision of the MOU, the Service agrees to extend the term of the leasehold for an additional two years, to March 2010. The MOU specifies the types of habitat that should be restored on the various properties within the leasehold and establishes the procedures the Service will follow when reviewing proposed leasehold enhancement projects.

Authorized wildlife-dependent recreational uses on the Refuge include environmental education and interpretation and wildlife observation and photography. Successful partnerships with the Chula Vista Nature Center, the San Diego Zoological Society, and SeaWorld have produced several regionally important environmental education programs, such as Sweetwater Safari.

The Chula Vista Nature Center was constructed on Gunpowder Point before the establishment of the Refuge. When the Court conveyed Gunpowder Point to the Service, it stipulated that the conveyance would be subject to the existing easement and license that had previously been granted by the landowner for the Chula Vista Nature Center. The Nature Center easement covers approximately 3.33 acres near the eastern edge of Gunpowder Point and the license provides the Nature Center with the ability to utilize the Refuge access road for a vehicle entrance and exit.

The Chula Vista Nature Center is operated by the City of Chula Vista and plays an important role in the Refuge's environmental education and interpretation programs. The Center is generally open to the public Tuesday through Sunday and can be accessed via a shuttle bus that transports visitors from a parking lot located near the intersection of I-5 and E Street.

### **1.7.3 Past Management Activities on the South San Diego Bay Unit**

Since the Refuge was established, management activities have been focused on posting signs along the Refuge boundary; monitoring seabird nesting activity on the salt works; conducting predator management to protect the endangered California least tern and light-footed clapper rail and the threatened western snowy plover; controlling invasive and weedy species on the Otay River floodplain; enhancing some of the salt pond levees; and enforcing Refuge regulations related to trespass. Wildlife-dependent recreational uses occurring on this Refuge are generally limited to the open waters of the bay and include fishing and wildlife observation and photography. Opportunities for wildlife observation are also provided during guided bird tours inside and adjacent to the salt works at appropriate times of the year, and for special events. Various recreational boating activities are also occurring within the Refuge boundary. A commercial solar salt evaporation facility operates on the Refuge under a Special Use Permit (SUP) between the Service and the San Diego County Airport Authority. To avoid adverse effects to federally listed and other trust species, the SUP includes various conditions that regulate activities on the salt works, particularly during the nesting season. The salt operator is responsible for maintaining the salt pond levees under the direction of the Refuge Manager.

Actions to enhance nesting habitat on the levees began in 2002 when clean, rough-grained sand was placed at a depth of approximately eight inches on the surface of several of the levees within the eastern portion of the salt works. This project was undertaken to reduce a significant limiting factor to successful nesting at the site involving eggshell adherence and soil concretions on the feet, feathers, and beaks of chicks due to existing soil conditions on the levees. The mortality of many developing embryos and young birds has been attributed to this effect in past nesting seasons. The first year of levee enhancement focused on adding a new sand cap to some of the most problematic sections of existing levees where ground nesting seabirds and shorebirds have previously nested.

Observations made during the 2003 nesting season indicated that substrate enhancement was successful in achieving its primary goal. No egg adherence or soil-to-foot concretions were

observed. However, this may have been partially due simply to limited precipitation, but it seemed clear to nest observers, based upon anecdotal observation, that the enhancement areas were preferentially used by some nesting species (*Collins pers. comm. 2003*).

Following completion of the initial project, additional areas were selected for enhancement. Enhancement activities are ongoing and occur during the non-breeding season. The effects of this enhancement on nesting preference and nesting success continue to be monitored as part of a larger least tern and snowy plover monitoring program that occurs on the Refuge during the nesting season.

In accordance with the terms of the Cooperative Agreement between the Service and the Port (refer to Section 1.6.3.) that resulted in the establishment of the Refuge, the Port has provided \$900,000 in mitigation funds to the Service for restoration of least tern foraging habitat, enhancement of least tern nesting areas, and management of tern nesting areas. From the \$900,000, a \$500,000 Management Endowment has been established that through interest payments will help fund annual maintenance, including biological monitoring and predator control. Of the remaining \$400,000, \$200,000 was provided to fund the development of restoration plans and the completion of the CCP for the South San Diego Bay Unit and \$150,000 is to be used to enhance a minimum of three acres of nesting habitat along the salt pond levees. Nesting enhancement involves placing six to eight inches of slightly compacted, clean, lightly-colored sand on the levee tops. The remaining \$50,000 is to be used to increase tern foraging habitat.

Additional information regarding current management activities on the South San Diego Bay Unit is provided in Section 2.3.2.1.

## **1.8 Refuge Vision and Goals**

### **1.8.1 Refuge Vision**

*The San Diego Bay National Wildlife Refuge protects a rich diversity of endangered, threatened, migratory, and native species and their habitats in the midst of a highly urbanized coastal environment. Nesting, foraging, and resting sites are managed for a diverse assembly of birds. Waterfowl and shorebirds over-winter or stop here to feed and rest as they migrate along the Pacific Flyway. Undisturbed expanses of cordgrass-dominated salt marsh support sustainable populations of light-footed clapper rail. Enhanced and restored wetlands provide new, high quality habitat for fish, birds, and coastal salt marsh plants, such as the endangered salt marsh bird's beak. Quiet nesting areas, buffered from adjacent urbanization, ensure the reproductive success of the threatened western snowy plover, endangered California least tern, and an array of ground nesting seabirds and shorebirds.*

*The San Diego Bay National Wildlife Refuge also provides the public with the opportunity to observe birds and wildlife in their native habitats and to enjoy and connect with the natural environment. Informative environmental education and interpretation programs expand the public's awareness of the richness of the wildlife resources of the Refuge. The Refuge serves as a haven for wildlife and the public to be treasured by this and future generations.*

## **1.8.2 Refuge Goals**

### **1.8.2.1 Sweetwater Marsh Unit**

The following goals provide guiding principles for the Sweetwater Marsh Unit. They are consistent with Refuge purposes, NWRS goals, the Improvement Act, Service policies, and international treaties. These goals apply to all of the management alternatives evaluated for this Refuge Unit.

*Goal 1: Protect, manage, enhance, and restore coastal wetland and upland habitats to benefit native fish, wildlife, and plant species within the Sweetwater Marsh Unit.*

*Goal 2: Support recovery and protection efforts for the federally and state listed threatened and endangered species and species of concern that occur within the Sweetwater Marsh Unit.*

*Goal 3: Protect and restore the environmental health of the Refuge's coastal salt marsh and upland habitats by making contaminants remediation a priority for Refuge lands, adjacent properties, and upstream developments.*

*Goal 4: Provide outstanding environmental education programs for all ages in partnership with the Chula Vista Nature Center and other public agencies and non-governmental organizations.*

*Goal 5: Provide quality wildlife-dependent recreation, interpretation, and outreach opportunities to enhance public appreciation, understanding, and enjoyment of the Refuge's biological and cultural resources.*

### **1.8.2.2 South San Diego Bay Unit**

The following goals provide guiding principles for the South San Diego Bay Unit. They are consistent with Refuge purposes, NWRS goals, the Improvement Act, Service policies, and international treaties. These goals apply to all of the management alternatives evaluated for this Refuge Unit.

*Goal 1: Protect, manage, enhance, and restore open water, coastal wetlands, and native upland habitat to benefit the native fish, wildlife, and plant species supported within the South San Diego Bay Unit.*

*Goal 2: Support recovery and protection efforts for the federally and state listed threatened and endangered species and species of concern that occur within the South San Diego Bay Unit.*

*Goal 3: Provide high quality foraging, resting, and breeding habitat for colonial nesting seabirds, migratory shorebirds and waterfowl, and salt marsh-dependent species.*

*Goal 4: Provide opportunities for compatible wildlife-dependent recreation and interpretation that foster public appreciation of the unique natural and cultural heritage of South San Diego Bay.*

## **1.9 Comprehensive Conservation Plan Process**

### **1.9.1 Overview of the Process**

The Improvement Act requires that every Refuge in the system prepare a CCP. Both the Service and the public benefit from this requirement, as the CCP process helps to ensure that each refuge fully evaluates, develops, and achieves its long-term vision and goals. Once a CCP is approved, the Refuge must follow the management priorities provided in the approved CCP.

The procedural provisions in the Council on Environmental Quality's Regulations for Implementing NEPA require all Federal agencies to integrate the NEPA process with other planning at the earliest possible time. In accordance with these regulations, the CCP Policy states that each CCP will comply with the provisions of the NEPA by concurrently preparing an EA or EIS to accompany or be integrated with the CCP. When preparing an EIS with a CCP, the two processes shall be integrated into one draft document. The purpose of integrating the two processes is to provide a systematic interdisciplinary approach; identify and analyze the environmental effects of the proposed actions; describe appropriate alternatives to the proposal; involve the affected State and Federal agencies, Tribal governments, and the affected public in the planning and decision-making process; and fully integrate all Refuge proposals that may have an impact on the environment. This Draft CCP/EIS for the Sweetwater Marsh and South San Diego Bay Units is intended to meet this dual requirement for compliance with the Improvement Act and NEPA.

The Draft CCP/EIS is available for public comment for a period of 60 days. Once the comment period has closed, all written and oral comments received on the Draft CCP/EIS will be reviewed and analyzed. Written responses will be prepared for all substantive comments and the CCP/EIS will be modified as appropriate. The Final CCP/EIS will identify the preferred alternative, which could be the proposed action, the no action alternative, another alternative, or a combination of actions or alternatives discussed in the Draft CCP/EIS. Following completion of the Final CCP/EIS, a stand-alone CCP, generally consisting of the preferred alternative and portions of Chapters 1, 3, 5 and Appendix D of the Final CCP/EIS, will be prepared.

The key steps in this CCP planning process include:

1. Forming the CCP planning team and conducting pre-planning tasks
2. Initiating public involvement and scoping
3. Identifying issues and developing a vision statement and goals
4. Developing alternatives and assessing their environmental effects
5. Identifying the Preferred Alternative
6. Preparing the Draft CCP/EIS
7. Publishing the Draft CCP/EIS for public review and comment
8. Responding to substantive comments and revising the document as necessary
9. Publishing the Final CCP/EIS at least 30 days prior to issuing a Record of Decision
10. Issuing the Record of Decision and providing the final, approved, stand-alone CCP
11. Implementing the CCP

### **1.9.2 The CCP Planning Team**

A planning team was formed to produce this CCP in February 2000. Recognizing the complexities involved in developing a CCP for this Refuge, the Service selected planning team members with a range of skills and technical knowledge. Core team members include representatives from the Refuge Complex, as well as from the Service's Coastal Program, Endangered Species Program, and Environmental Contaminants Division. Others who provided the team with assistance on specific CCP tasks included representatives from the Carlsbad Field Office's GIS Mapping and

Analysis Section, the NWRs's Branch of Cultural Resources and Branch of Refuge Biology, and the Service's Migratory Birds Program. The California Department of Fish and Game was also invited to participate on the Planning Team, and the core team met on several occasions with other interested and/or affected agencies, including NOAA Fisheries and the Regional Water Quality Control Board. The planning team also organized several technical workshops with researchers, consultants with expertise in coastal restoration planning, and representatives from other agencies to address topics, such as coastal salt marsh restoration, brine invertebrates, saline systems, and colonial nesting seabirds. Ducks Unlimited, Inc. (DU) was included in the CCP process through a Cooperative Agreement involving DU, Refuges, and the Coastal Program. With funding provided by the Coastal Program, DU provided technical support needed to design restoration proposals for the South San Diego Bay Unit. The Coastal Program also funded analysis specific to coastal restoration involving engineering and hydrological consultation. A list of CCP Planning Team members, document preparers, and other participants is provided in Chapter 6.

### **1.9.3 Public Involvement in the CCP Process**

Public involvement has been an essential component of this CCP process. From the beginning of the process through the distribution of the Draft CCP/EIS, every effort has been made to provide the public with detailed information about the process and the proposed action.

The CCP planning team formally initiated this CCP process in June 2000, by publishing a Notice of Intent in the Federal Register, issuing the first in a series of Planning Updates, and inviting the public to attend an initial scoping meeting. Between July 2000 and June 2001, the team held a series of public workshops to address a range of issues related to the CCP process. In July 2000, two initial scoping meetings were held to receive general comments about current and future management of the San Diego Bay NRW. These initial meetings were followed by a workshop on general public use issues in September 2000. Three meetings addressing issues related to wildlife management and restoration were held in November 2000, March 2001, and May 2001. In June 2001, another meeting was held to address public use proposals.

Throughout the process, the team distributed meeting notices and Planning Updates to over 1,000 Federal, State, and local agency, Tribal governments, non-governmental organizations, and individual contacts. The CCP planning team also developed a CCP web page to provide an additional opportunity for the public to review information presented at our public meetings. The web page also provided the Planning Team with a tool for soliciting public comments throughout the planning process. Chapter 5 of this document provides additional details regarding the public involvement and outreach program that has been implemented for this CCP.

### **1.10 Planning Issues**

Planning issues were identified through discussions with planning team members and workshop participants, and through the public scoping process. From these discussions and input provided during scoping, seven major issues were identified for the Sweetwater Marsh Unit and six major issues were identified for the South San Diego Bay Unit. Each of the issues presented, below was considered during the development of management alternatives for each Refuge Unit. A summary of all of the issues raised and comments provided during public scoping is provided in Appendix E.

### **1.10.1 Major Issues Identified During the Scoping Process for Sweetwater Marsh Unit**

#### **Issue 1: Refuge Boundary Expansion**

***Should the Refuge boundary be expanded to include the intertidal mudflats that occur immediately to the west of the Sweetwater Marsh Unit?***

Prior to human disturbance, the Sweetwater River estuary supported extensive areas of coastal salt marsh, a system of tidal channels, intertidal mudflats, and salt pans. Today, the Sweetwater Marsh Unit includes most of what remains of the coastal salt marsh habitat within the historic Sweetwater River estuary, while the majority of the remaining intertidal mudflats that once extended well to the north and south of Sweetwater Marsh are located immediately to the west of the Refuge. This area consists of approximately 200 acres and represents about 37 percent of the total remaining intertidal mudflat habitat within the bay. The intertidal mudflats adjacent to Sweetwater Marsh were identified for possible inclusion in the Refuge when the original proposal to establish a national wildlife refuge over the Sweetwater Marsh mitigation/preservation areas was presented to the Director of the Fish and Wildlife Service in December 1986. However, when the Stipulated Settlement Agreement was approved, the intertidal mudflats were not included within the approved Refuge boundary.

During the CCP scoping process, the public voiced considerable interest in examining the feasibility of expanding the Refuge boundary to incorporate the adjacent mudflats into the Sweetwater Marsh Unit. The intent was to ensure the long-term protection of this habitat, which supports a significant population of wintering shorebirds and migratory waterfowl. Protection of the salt marsh habitat alone cannot satisfy the foraging needs of these shorebirds and the other fish and wildlife species that have historically utilized the variety of intertidal habitats that occurred within the South Bay.

The public also offered the opinion that a more comprehensive habitat management program could be implemented if both the salt marsh and the adjacent mudflats were managed by the same entity. Currently, management of the salt marsh habitat is the responsibility of the Service, while management of the activities occurring on the adjacent mudflats is the responsibility of the Port. This separation of management authority has the potential to reduce the effectiveness and enforcement capability of both entities, resulting in impacts to the resources due to the lack of enforceable resource protection regulations outside of the existing Refuge boundary. Of particular concern is the presence of free-roaming dogs and associated human disturbance on the mudflats. These activities result not only in frequent disturbances to foraging shorebirds, but also often result in trespass onto Refuge lands and further disturbance of sensitive bird species. Several members of the public stated that by expanding the Refuge boundary to incorporate the intertidal mudflats, the Service could establish and enforce use regulations that would minimize disturbance to sensitive wildlife both on the mudflats and within the salt marsh.

Options for managing this area as part of the Refuge were explored during the CCP process and included expanding the Refuge boundary to include this area and managing the area under an agreement between the Service and Port. Additional discussion regarding this issue is included in section 2.2.3.1.

#### **Issue 2: Improved Tidal Circulation**

***Should tidal circulation within the marsh be improved, and, if so, to what extent should this occur?***

Prior to the construction of the flood control channel at 24<sup>th</sup> Street, the Sweetwater River provided freshwater inflows into Sweetwater Marsh. According to the Final EIS for the flood control



project, under historic conditions the marsh received flood waters up to ten times per year (*U.S. Army, Corps of Engineers 1982*). Following construction, these primary freshwater flows were diverted out of the wetlands and into the flood control channel. The result of this project was fragmentation of the wetlands complex. Paradise Marsh was separated from Sweetwater Marsh, which changed the capacity and function of the historic tidal prism in the wetland complex. These changes, as well as the construction of the access road from E Street to Gunpowder Point, have all contributed to the degradation of the marsh's tidal circulation. Many tidal channels and creeks that were once connected have been severed and are now becoming filled with silt. As a result, cordgrass habitat is being replaced by high marsh vegetation dominated by pickleweed (*Salicornia virginica*) and glasswort (*Salicornia subterminalis*). The specific effect of this loss of tidal prism has been a gradual degradation of the marsh's ability to support a viable clapper rail population. The Draft CCP/EIS evaluates several proposals for improving tidal circulation within Sweetwater Marsh, in accordance with the recovery actions outlined in the Recovery Plan for the Light-footed Clapper Rail (*USFWS 1985*).

### **Issue 3: Identification and Remediation of Contaminants**

#### ***What management actions are necessary to ensure adequate identification and remediation of various contaminants known or suspected to occur within the Refuge boundaries?***

Field observations, historic records of past land use activities, and limited soil and water sampling suggest that contaminants are present in several locations within the boundaries of the Sweetwater Marsh Unit and may be present, but have not yet been confirmed, in other portions of the Refuge. A preliminary assessment of potential contaminant issues within the Refuge boundary was conducted in March 1988. This assessment determined that the presence of environmental contaminants may be suspected based on the heavy municipal, military, and industrial past and present use of the San Diego Bay and adjacent lands (*USFWS Memorandum, March 7, 1988*).

In 1996, the County of San Diego, Department of Environmental Health determined that properties in the vicinity of Paradise Marsh in National City were used as a municipal solid waste burn dump from about the late 1930s to early 1950s. Burn ash often contains concentrations of heavy metals and other chemical constituents that could pose a threat to public health and safety, as well as to fish, wildlife, and their habitats. Soil sampling conducted between 1973 and 1984 showed an area of lead-contaminated materials in the general vicinity of the Refuge; however, the extent of contamination and whether it extends onto Refuge property has not been determined. Although those areas identified as potential burn ash sites are inspected quarterly, the extent of contamination and the actions required to remediate the sites have yet to be identified. Initial review also indicates the potential for contaminants to be present on Gunpowder Point and in sediments at the F&G Street Marsh.

During the scoping process for the CCP, the planning team identified as a high priority the need to characterize the extent and type of contaminants present within the Refuge. Since that time, the Refuge complex and the Carlsbad Fish and Wildlife Office, Division of Environmental Contaminants have completed a Contaminant Assessment Process (CAP) for the Sweetwater Marsh and South San Diego Bay Units. The CAP is a standardized and comprehensive approach for documenting and assessing potential threats posed by environmental contaminants to lands and biota within refuges. Based on the information available regarding conditions within and adjacent to the Refuge, additional contaminants assessments and site characterizations appear warranted.

#### **Issue 4: Habitat Restoration**

##### ***How much, if any, of the D Street Fill should be restored to intertidal habitat?***

The D Street Fill is located between the historic Sweetwater River channel to the south and the 24<sup>th</sup> Street flood control channel to the north. This 85-acre dredge disposal site was created in 1969 as a result of the construction of the western end of the 24<sup>th</sup> Street channel and an associated marina. When the Sweetwater Marsh Unit was established, approximately 52 acres of this fill site were included within the Refuge boundary. The Port retains ownership of the rest of the D Street Fill, including 12 acres at the western end and about 21 acres along the site's northern perimeter. Of the 52 acres included in the Refuge boundary, 13 acres were designated as a least tern nesting site. Since Refuge establishment, an additional 10 acres of Refuge property on the D Street Fill have been designated for management as least tern nesting habitat and 1.5 acres have been converted to tidal habitat. These actions were the result of mitigation measures required to offset impacts associated with development elsewhere in the bay. The remaining 26.9 acres are included in a mitigation leasehold overlay established through the MOU, dated March 27, 1998, between Chula Vista Capital and the Service. Currently, the MOU states that the permissible and preferred uses of this leasehold are salt marsh restoration. An issue raised during public scoping, as well as by the planning team, was whether more of the D Street Fill area should be retained and managed for California least tern and western snowy plover nesting, or the area should continue to be designated for restoration to intertidal habitat.

Prior to disturbance, the site of the D Street Fill supported intertidal mudflat and salt marsh habitat. Once constructed, the fill remained unvegetated for several years as a result of uncontrolled public access and off road vehicle activity. In 1973, least tern nesting was observed for the first time on this fill site (*USFWS 2002*). Since 1978, least terns have been recorded attempting to nest at this location 21 out of the 24 years. The site was used regularly between 1994 and 2001, but fledgling production was poor in four of those eight years. The question of whether to restore most of the D Street Fill to wetland habitat, which the site historically supported, or manage more of the area as potential nesting area was addressed at two public workshops. Service staff also discussed this topic at several planning team meetings and during a Wildlife Habitat and Management Review conducted by the Service's Regional Office. An objective of the planning team in developing the management goals for the Sweetwater Marsh Unit, as well as the South San Diego Bay Unit, was to develop management goals that are science-based and reflect the principles of conservation biology including the maintenance of biological integrity, diversity, and environmental health pursuant to the Improvement Act.

#### **Issue 5: Management of Invasive Species**

##### ***What actions should be undertaken to prevent, control, and/or remove invasive species that could negatively impact the biological value of the Refuge's important coastal resources?***

Another issue raised during the public scoping process was the need to identify current and potential invasive species problems on the Refuge and develop and implement appropriate management responses. The Refuge's habitats have been impacted by a variety of non-native invasive species. For example, the quality of the Refuge's salt marsh habitat, particularly the habitat within the marsh's tidal channels, has been compromised to some extent by the presence of the exotic benthic invertebrate, *Sphaeroma quoyanum*. This isopod, which originates in the southern Pacific, is found in extremely high densities in the banks of the marsh's tidal channels where its burrowing activity has converted the gentle banks of the channel to steep, often undercut slopes. These structural changes to the tidal channels could be having negative impacts on a variety of species within the marsh, including native benthic populations, shorebirds, and the light-footed clapper rail.

The magnitude of the exotic species invasion problem in San Diego Bay and in other coastal wetlands is largely unknown. Many of the marine associated species group's taxonomy are not well documented. Bilge water discharges and illegal aquarium dumping are presumed to present serious risks to the estuarine and near-shore marine environments of the bay, including the intertidal habitats of Sweetwater Marsh Unit. It is acknowledged that preventing the introduction of exotic aquatic and benthic organisms requires the cooperation of all of the stakeholders within San Diego Bay. However, for the Refuge, understanding how these organisms might impact coastal resources and identifying effective measures for controlling or eliminating these species, if introduced, is a long-term management issue that must ultimately be addressed.

An example of the extent of damage that could occur to the local marine environment as a result of the introduction of an exotic species is *Caulerpa taxifolia*, marine algae that has destroyed thousands of acres of marine habitat in the Mediterranean Sea. This species was identified in Aqua Hedionda Lagoon, a San Diego coastal lagoon located approximately 40 miles north of San Diego Bay. After several years of costly control procedures, this species was successfully eliminated.

The presence of non-native invasive plant species is a common problem for natural areas that occur along the urban interface. Many invasive species can displace native vegetation and often require annual control, such as giant cane (*Arundo donax*), tamarisk (*Tamarix* spp.), garland chrysanthemum (*Chrysanthemum coronarium*), fennel (*Foeniculum vulgare*), tree tobacco (*Nicotiana glauca*), pampas grass (*Cortaderia jubata*), and castor bean (*Ricinus communis*). Other non-native invasive plant species have been recorded in San Diego County, but have not yet invaded the native habitats of the Sweetwater Marsh Unit. It is only through aggressive management actions that existing invasive species can be controlled and the future presence of other species can be avoided.

#### **Issue 6: Predator Management**

***Should the current predator management strategies being implemented on the Refuge be expanded or modified? Are there other management strategies that should be considered that, if implemented, would more effectively achieve the Refuge purpose of protecting endangered and threatened species?***

The sensitive coastal habitats of Sweetwater Marsh Unit are situated in the midst of a densely populated urban area. As a result, the open spaces of the Refuge tend to attract domestic and feral dogs and cats. To complicate matters, the scarcity of undeveloped land in the vicinity of the Refuge results in more intensive predation from the remaining local wildlife community, including native and non-native mammalian and avian predator species. Many of these predators continue to survive or become abundant in this urban setting because they are generalists or scavengers, demonstrating little if any prey discretion. The combination of these factors significantly increases the vulnerability of the Refuge's endangered and threatened species to predation.

Mammalian and avian predator management is currently conducted on this Unit. The program focuses on the protection of listed species, particularly the California least tern, western snowy plover, and light-footed clapper rail. Managed species include feral dogs and cats, native and introduced mammals, and predatory birds. During scoping, the planning team was encouraged to evaluate the long-term effectiveness of the current predator management program. Potential changes to the program should be evaluated that would ensure better protection of threatened and endangered species, while also emphasizing effective non-lethal predator management methods. The combination of effective predator management, in association with the enhancement of nesting substrate in preferred nesting areas, is thought to be more effective for least tern and snowy plover reproductive success than simply controlling predators. The predator management plan is described in detail in Appendix M.

**Issue 7: Effects of Urban Development on Refuge Resources*****How can current Refuge management practices be enhanced to better address the impacts of adjacent development on Refuge resources?***

The Sweetwater Marsh Unit is located in a highly populated region that supports a variety of urban land uses, including residential, commercial, industrial, and active and passive recreation. Immediately to the north of the Refuge are maritime-related uses associated with the Port of San Diego. The closest Port activities include ship berthing and 24-hour off-loading of large cargo ships, involving the need for substantial night lighting visible from within the Refuge. Other uses in the vicinity of the Refuge include industrial and recreational development to the north within the City of National City, industrial development to the south, and commercial and residential uses to the east of I-5, all within the City of Chula Vista. Currently, the property immediately to the east of the Refuge is vacant. However, future development plans for this property and other properties along the Chula Vista Bayfront are currently being prepared by the City of Chula Vista and the Port. Potential uses in the vicinity of the Refuge Unit could include commercial, office, hotel/resort, and active and passive open space. The potential also still exists for residential development to occur in proximity to the Refuge, as the future use of the properties within the Chula Vista Bayfront master plan area are dependent upon various approvals required from the California State Lands Commission and other agencies.

Because of the proximity of the Refuge to existing urban uses, many of the management actions undertaken by Refuge staff are directly related to unauthorized use of the Refuge. Examples of such unauthorized use include illegal dumping, trespass into sensitive resource areas, vandalism to locks, fences, and signs, illegal encampments, and allowing pets, particularly dogs, to roam off-leash on Refuge lands. Other impacts from surrounding development include degraded water quality resulting from upstream urban runoff; the introduction of hazardous substances into the surface and ground water from existing and past industrial uses; adjacent night lighting that spills over onto sensitive nesting areas; and the release of feral cats and dogs into the area. During the scoping process, the planning team identified the need to expand enforcement activities on the Refuge and to work with other agencies to implement design and development standards that would reduce direct and indirect impacts to Refuge resources. The quality of the water entering the Refuge from upstream sources is of particular concern. Plans for new development in proximity to the Refuge, make it necessary to identify and evaluate the type and extent of additional management actions that might be required to ensure the long term protection of the Refuge's sensitive resources.

**1.10.2 Major Issues Identified During the Scoping Process for the South San Diego Bay Unit****Issue 1: Incorporate In-holdings Into Refuge Management Area*****Should the Refuge Complex continue to pursue management authority for all of the areas within the approved acquisition boundary for the South San Diego Bay Unit?***

The approved acquisition boundary for the South San Diego Bay Unit includes approximately 3,940 acres; however, at present, the Service only has management authority over 2,300 acres. The majority of the open bay that is located within the acquisition boundary of the Refuge Unit, but outside the current management boundary (an area of approximately 1,130 acres) is State Tidelands that are managed by the Port. Approximately 35 acres of these bay tidelands located in the southwestern corner of Emory Cove and just to the north of Pond 11 are owned by the Navy and leased to the County of San Diego, Department of Parks and Recreation. This area is referred to as the South Bay County Biological Study Area. During the public scoping meetings, several individuals suggested that the wildlife and habitat resources of the South Bay could be better protected if one entity retained management authority over all of the land and waters included

within the approved Refuge acquisition boundary. This situation would facilitate uniform enforcement of existing regulations, such as the 5 miles-per-hour speed limit that is posted for much of the South Bay, and would ensure the comprehensive review of public uses proposed for the area. Discussions between the Port and the Service regarding a comprehensive approach to managing these areas are ongoing.

## **Issue 2: Habitat Restoration and Management of the Salt Ponds**

### ***Should the salt ponds within the Refuge be restored to intertidal habitat? If so, to what extent should this occur?***

The south end of San Diego Bay has been the site of an active solar salt operation since the late 1800s. Today's facility has operated in its current configuration for over 50 years and a smaller version of the salt works (which did not include the outer primary ponds) has existed since at least 1916. South Bay Salt Works currently operates under a Special Use Permit between the Service and the San Diego County Airport Authority. Under the current agreement, the operator is responsible for all levee management and water movement within the ponds.

The ponds provide resting and loafing habitat for an abundant and diverse group of migratory birds that travel along the Pacific Flyway. Brine invertebrates including brine flies (*Ephydra* sp.) and brine shrimp (*Artemia* sp.) are also abundant in some of the ponds, providing prey for various avian species, including phalaropes (*Phalaropus* sp.) and eared grebes (*Podiceps nigricollis*). The levees also provide important nesting habitat for a variety of colonial nesting seabirds, as well as two federally-listed species, the endangered California least tern and threatened western snowy plover. The variety of birds using the salt ponds levees for nesting is due in large part to the isolated nature and minimal threat of human disturbance provided at this site. These attributes are relatively scarce along the highly urbanized southern California coast.

Much of the area now occupied by the salt works historically supported coastal wetlands, primarily intertidal mudflats and coastal salt marsh (*U.S. Navy 2000*). Today in San Diego Bay, only remnants of the vast acreage of coastal wetlands that once occupied the areas around the bay have been preserved. The remainder has been filled or dredged to accommodate port development and associated commercial, industrial, and residential uses.

Although the salt works displaced a large area of historic native migratory bird habitat in the south bay, the ponds and levees do provide resting, loafing, and foraging opportunities for a large number of birds and a number of the salt pond levees also provide important nesting habitat for ground nesting birds, including seven species of seabirds. However, because of the high salinities within most of the salt ponds, this area provides very little habitat value for fish, aquatic plants, and bay invertebrates. In addition, approximately 15 percent (about 160 acres) of the system (the pickling, crystallizer, and magnesium chloride ponds) provide virtually no habitat value for wildlife.

During the scoping process, a range of perspectives were presented regarding the future of the solar salt operation. Some suggested that the existing benefits of the salt works for shorebirds and nesting seabirds were so significant that no changes to the current operation should be considered. Others expressed their desire to see the overall habitat value of the area enhanced by restoring intertidal habitat to some or all of the area currently occupied by the salt works. Technical issues also arose related to desalinating the salt ponds to accommodate habitat restoration. There were clearly certain features or aspects of the existing salt ponds that the majority of the respondents felt should be preserved and/or enhanced. These included retaining, and in some cases enhancing, portions of the existing levee system in order to accommodate nesting areas for colonial seabirds; maintaining an adequate area of hypersaline habitat to ensure the continued production of brine shrimp and brine flies; and continuing to manage this area in a manner that would maintain the low

disturbance levels experienced at this location over the past 100 years. These options are addressed in the range of alternatives evaluated for this Refuge (refer to Chapter 2).

### **Issue 3: Floodplain Management and Habitat Restoration in the Otay River Floodplain**

***What are the existing flood hazards in the Otay River floodplain? Could habitat restoration within the floodplain alter existing upstream or downstream flood flow characteristics? How much restoration should occur and what types of habitat should be restored?***

Included within the South San Diego Bay Unit are 145 acres of upland and wetland habitat located within the 100-year floodplain of the Otay River. Nestor Creek also flows through this area, merging with the Otay River near its convergence with San Diego Bay. The flows of both the Otay River and Nestor Creek are constricted in this area by a series of levees associated with the salt ponds to the north. In the early 1900s, the natural course of the Otay River was altered to accommodate the development of the salt works. The Otay River presently crosses the site within a diked channel that extends westward from I-5, then turns north at the point where it crosses the Saturn Boulevard right-of-way. The channel then turns west paralleling the railroad, until emptying into the San Diego Bay near 9<sup>th</sup> Street in Imperial Beach.

Under current conditions, this portion of the Refuge is subject to flooding during a 100-year flood, as are some of the existing developments to the south. The low flow channels of both the Otay River and Nestor Creek carry the smaller storm flows to the bay; however, larger flows collect behind the levees that constrict the natural flows of these waterways. If the flows are large enough, the floodwaters will overtop the levees and flow into the adjacent salt ponds. The backwater effect that currently occurs at the confluence of Nestor Creek and the Otay River results in higher flood levels upstream of Nestor Creek.

The existing Otay River floodplain has been altered by a combination of agricultural activities and urban development. The portion of the floodplain located within the Refuge supported farming activities until 1986. Today, non-native weeds and exotic grasses dominate the upland portions of the site. The freshwater wetland habitat of the Otay River includes components of southern willow scrub habitat, as well as a variety of exotic, invasive wetland species such as giant reed, salt cedar, and castor bean. This freshwater wetland habitat transitions into salt marsh habitat about 0.5 miles downstream of I-5, at which point the channel supports coastal salt marsh species, such as pickleweed and sparse stands of cordgrass (*Spartina foliosa*).

During the scoping process, the public identified the need to address potential flooding problems on the Refuge and in the surrounding developed areas. In addition, several members of the public expressed a desire to see the Otay River floodplain restored to native wetland and upland habitat. As a result of these initial comments, the planning team reviewed the potential for restoration in this area. Additional information related to the tidal and river hydrology in the area would be needed to evaluate the feasibility of restoration and to address existing flooding issues. Restoration options for the Otay River floodplain are described in Chapter 2. The existing hydrological characteristics of this area are summarized in Chapter 3 and described in greater detail in Appendix I. The potential effects of restoration on the existing flood conditions in this area are described in Chapter 4.

### **Issue 4: Managing for California Least Terns, Western Snowy Plovers, and Gull-billed Terns**

***Is it possible to implement management actions on this Refuge that will assist in the recovery and conservation of all three of these trust species?***

The California least G, western snowy plover, and western gull-billed tern (*Gelochelidon nilotica vanrossemi*) all nest on the salt pond levees within the South San Diego Bay Unit and each of these species has benefited from the various management actions that are implemented on the Refuge to

conserve the Refuge's listed species. The three species are all protected under International Treaties and various Federal and State laws. In addition, the least tern is federally-listed as endangered and the snowy plover is listed as threatened, therefore, both of these species are protected under the authorities of the ESA. The gull-billed tern is not federally-listed as threatened or endangered; however, because of its declining population trends and threats to breeding birds, it has been identified by the Service as a Bird of Conservation Concern (*USFWS 2002*). The best scientific data available for this subspecies indicate a small population of less than 600 known nesting pairs range wide and a limited distribution with ten known breeding sites, only two of which are located within the United States. Approximately seven percent of the total population of this subspecies nests at the salt works.

Current management actions that have provided direct benefits to all three species include protecting the site from human disturbance and improving nesting substrate on the salt pond levees. Gull-billed terns also receive indirect benefits from mammalian and avian predator management that is implemented to improve the reproductive success of least terns and snowy plovers. Predation of least tern and snowy plover eggs and chicks has been recorded on the salt works for over twenty years. The effect of predation on fledging success varies from year to year, but in some years the effects can be dramatic and devastating to the colony. In recent years, the issue of managing for avian predation has become more complicated, as gull-billed terns have been observed preying on least tern and snowy plover chicks, not only at the salt works, but elsewhere around the bay and adjacent coastal areas. To date, no actions have been taken to remove offending gull-billed terns from the Refuge.

The current situation has raised questions as to whether the control of offending gull-billed terns should be initiated and if initiated what effects could this control have on the gull-billed tern nesting colony at the salt works. Other related questions include: to what extent are gull-billed tern foraging activities impeding the recovery of least terns and snowy plovers in San Diego Bay and are there other management options that could be implemented to reduce gull-billed tern predation on least tern and snowy plover chicks and eggs?

The various programs within the Service, including Migratory Birds, Refuges, and Ecological Service, are currently working together to address these and other questions in an effort to identify management actions that would achieve the recovery goals of the least tern and snowy plover, while also supporting the continued reproductive success of the gull-billed tern in Southern California. Actions are already being implemented that we hope will increase our understanding of the effects and interrelationship of these species. These actions include limited monitoring of gull-billed tern nesting and foraging activities on the Refuge; monitoring of nesting activity, reproductive success, and predation of least terns and snowy plovers; and conducting range wide surveys for the western gull-billed tern.

#### **Issue 5: Wildlife-Dependent Recreational Uses**

***Should the current wildlife-dependent recreation uses on the Refuge be expanded? If so, what opportunities for wildlife-dependent recreational uses are available that would satisfy the needs of the surrounding community, while conserving the Refuge's trust resources?***

The South San Diego Bay Unit consists primarily of open bay waters, salt ponds, intertidal areas, and disturbed uplands. Public access onto the Refuge is limited to activities that can be conducted from a boat, personal watercraft, or sailboard on the open waters of the bay. Public access into the salt works and along the salt pond levees is only permitted during occasional guided tours conducted for purposes of wildlife observation and interpretation. The remainder of the Refuge is closed to all public access. Public uses currently occurring in the open waters of the bay include recreational boating, fishing in accordance with State regulations, wildlife observation,

interpretation, and photography. Visual access into the Refuge is available from the public rights-of-way that extend around the south end of the bay, including the Bayshore Bikeway, and from the Biological Study Area, maintained by the County of San Diego.

During the public scoping process, the public provided considerable input regarding the types and intensities of uses that should be implemented on the Refuge. There were requests to develop environmental education programs for the elementary schools in the immediate area, to open the salt works levees to public access for wildlife observation, and to provide opportunities for remote viewing of nesting activity on the levees through the use of video cameras. Others requested that trails be developed in the Otay River floodplain that would link the Refuge to the main trail system proposed for the Otay Valley Regional Park and that the establishment of an interpretive kayak trail be considered. A waterfowl hunting program was suggested, as was opening the salt ponds to fishing and permitting dog trials to be conducted within the Refuge. Others stated that the Refuge's management goals should emphasize wildlife and habitat protection over public recreation uses and that no uses should be permitted that would negatively impact endangered species, migratory shorebirds, or nesting seabirds. The public use options considered for the Refuge are described in detail Chapter 2.

#### **Issue 6: Waterfowl Hunting**

##### ***Should waterfowl hunting be permitted on the Refuge?***

Although hunting is a part of San Diego Bay's history, hunting has not legally occurred anywhere in the South Bay for more than thirty years. Historically, market hunting of shorebirds was a common practice in the South Bay, but this practice ended with the passage of the Migratory Bird Act of 1918. Waterfowl hunting continued to occur in the area until about 1970. Since its establishment in 1999, the South San Diego Bay Unit has been closed to hunting.

During the scoping process for the CCP, several members of the public requested that hunting be evaluated in the Draft CCP/EIS and approved as one of the uses to be permitted on the Refuge. Others expressed opposition to this idea, stating that hunting was not appropriate on an urban refuge established to protect endangered species.

The potential for opening the Refuge to waterfowl hunting generated significant public comment both in support and in opposition. These comments were provided in the form of letters, emails, and telephone calls to the Refuge office. Some individuals stated that the Refuge should be opened to waterfowl hunting because hunting has historically occurred in the South Bay; therefore, it is a heritage that should be allowed to continue. Others indicated that they support opening the Refuge to hunting, because of the limited opportunities available for hunting in the San Diego region. Those who presented comments in opposition stated that hunting in such an urban area posed a threat to public safety; the activities associated with hunting would be incompatible with nearby residential uses; and hunting would displace the wintering shorebirds. Opening the Refuge to waterfowl hunting is not proposed at this time for the reasons addressed in Section 2.3.3.3.



# *Chapter 2 – Alternatives*

## **2.1 Introduction**

An important step in the CCP planning process is the development and analysis of alternatives. Alternatives are developed to explore and analyze different ways to achieve Refuge purposes, contribute to the mission of the NWRs, meet Refuge goals, and resolve issues identified during scoping and throughout the CCP process. This chapter describes the process that was followed to develop management alternatives for the Sweetwater Marsh and South San Diego Bay Units, and provides detailed descriptions of these alternatives. Each Unit is addressed in a separate section, with each section containing a comparison of the alternatives considered, a summary of the similarities among those alternatives, and a discussion of alternative components that were considered, but eliminated from detailed study. The “preferred” management alternative for each Refuge Unit is also identified.

Preferred alternatives may be modified following the completion of the public review and comment period based on comments received from the public or another agency. The Final EIS will include a “proposed decision” for each Refuge Unit. The proposed decision may look very similar to the preferred alternative, or it could include a combination of components from two or more of the alternatives presented in the draft CCP/EIS.

As a joint CCP/EIS, this document is intended to fulfill the Service’s responsibilities under NEPA. Therefore, considerable effort was taken to develop a reasonable range of feasible management alternatives for each Refuge. The Council on Environmental Quality’s NEPA Regulations describe the alternatives section as the heart of the EIS. As such, the alternatives presented in an EIS should be reasonable and implementable, must be given equal treatment, and must provide clear choices for the decision maker. A reasonable range of alternatives generally includes several “action” alternatives and a “no action” alternative. The action alternatives involve various changes to past and present management activities, while the no action alternative would result in no change to current management practices. The no action alternative serves as the baseline to which all other action alternatives are compared.

### **2.1.1 Alternative Development Process**

The development of alternatives is not a sequential process. Proposed alternatives are changed or further refined based on the findings of issue assessment; development of goals, objectives, and strategies; and an analysis of impacts and benefits. Before the process of developing alternatives began, the planning team reviewed and evaluated the scoping comments received in response to the Notice of Intent (NOI), as well as the comments provided at a series of public workshops held to discuss management activities and public uses on the Refuge. A list of major issues related to the management of the San Diego Bay NWR was developed using this input, along with additional input from the planning team and other Service staff (refer to Section 1.10). Once the issues were defined, the team began the process of articulating the Refuge vision and goals. Through further analysis of the issues and general public comment, the team developed various objectives and strategies for achieving Refuge goals, the mission of the NWRs, and other mandates. The objectives and strategies address wildlife and habitat management, habitat enhancement and restoration, maintenance and monitoring, environmental contaminants investigation and remediation, fire management, protection and management of cultural resources, and public use.

The potential for habitat enhancement and/or restoration on the two Refuge Units was an important consideration in developing the alternatives. This was particularly true for the South San Diego Bay Unit, which was established, in part, to enable consideration of potential restoration opportunities within the existing salt ponds. As part of the process of developing enhancement and restoration options, the planning team sought input from Refuge stakeholders, biologists experienced in the ecological study and restoration of coastal habitats, and the public at large. To facilitate public discussion, the planning team held several focused workshops. The first workshop was held in February 2001 addressed general issues related to habitat management and restoration. From the discussions at that meeting and a series of subsequent planning team meetings, nine conceptual enhancement and restoration options were prepared for the South San Diego Bay Unit. Another public workshop was held in March 2001 to receive public input on these nine conceptual proposals. The restoration proposals were also posted on the CCP web page and additional comments were solicited. After considering the input generated at these meetings and through the web page, the planning team further refined the enhancement and restoration options and incorporated the options into distinct alternatives. These enhancement and restoration alternatives were discussed at a public workshop held on May 22, 2001. Also during the May 2001 meeting, the planning team introduced enhancement and restoration options for portions of the Sweetwater Marsh Unit. Management alternatives for the Sweetwater Marsh Unit were then developed using the same process used to develop alternatives for the South San Diego Bay Unit. The enhancement and restoration alternatives were further refined during the analysis of environmental consequences.

The public use components of each alternative were developed in a similar manner. Priority consideration was given to uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation (refer to Section 1.5.2.1 for more information regarding wildlife-dependent recreational uses). The planning team also evaluated those uses already permitted on the Refuge, as well as various other uses suggested by the public and interested agencies during scoping and at the public use workshops. As a result, a range of public use proposals have been incorporated into the various alternatives for each Refuge Unit.

The alternatives that have been developed for the Sweetwater Marsh and South San Diego Bay Units are summarized below and described in detail in Sections 2.2 and 2.3.

## **2.1.2 Summary of Alternatives for Each Refuge Unit**

### **2.2.1.2 Sweetwater Marsh Unit**

- **Alternative A, No Action** – This alternative assumes no change to past and present management activities on this Refuge Unit. Under this alternative, there would be no new wildlife and habitat management programs, no proposals to enhance or restore habitat, and no changes to the current public use program.
- **Alternative B, Implement Habitat Enhancement** – This alternative places greater emphasis on habitat management and enhancement, particularly the enhancement of tidal circulation within the Unit's intertidal habitats and enhancements at the D Street Fill to benefit nesting seabirds and plovers. Opportunities for wildlife observation and environmental education would remain unchanged; however, new opportunities for environmental interpretation are proposed at Paradise Marsh and F&G Street Marsh.
- **Alternative C, Preferred Alternative: Implement Habitat Enhancement and Restoration and Improve Existing Public Uses** – This alternative further expands the wildlife and habitat management activities described in Alternative B to include

both habitat enhancement and habitat restoration. Various proposals for restoring intertidal, upland, and upland transitional habitats are presented. In addition, the trail system and associated interpretive elements on Gunpowder Point would be redesigned to complement existing environmental education and interpretation programs.

### **2.1.2.2 South San Diego Bay Unit**

- **Alternative A, No Action** – This alternative assumes no change to past and present management activities on this Unit. As a result, the management practices identified as necessary when the Unit was established in 1999 would continue to be implemented. This would include actions required to enhance nesting and foraging opportunities for the California least tern, as described in the Cooperative Agreement between the Service and the Port (refer to Section 1.6.3). The public uses currently permitted on the Unit, including fishing, wildlife observation, environmental education, and boating, would be retained at present levels and no new uses would be initiated. In addition, commercial solar salt production would continue to operate on the Refuge Unit under a Refuge Special Use Permit.
- **Alternative B, Expand Habitat Management and Enhance Nesting Opportunities**  
Under this alternative, habitat values for California least tern, western snowy plover, and colonial nesting seabirds would be improved by enhancing the nesting substrate on various salt pond levees, recontouring levee surfaces to improve access from nesting areas to the edge of the ponds, and increasing overall acreage of potential seabird nesting habitat within the salt pond system. This alternative also proposes the creation of additional roosting habitat within the salt ponds for California brown pelicans (*Pelecanus occidentalis californicus*). Existing public uses would continue, however no new uses would be provided. Commercial solar salt production would also continue under this alternative.
- **Alternative C, Expand Habitat Management, Enhance Nesting Opportunities, Implement Habitat Restoration, and Expand Existing Public Use Opportunities**  
This alternative proposes to restore native habitat within the Otay River floodplain and within some of the existing salt ponds. The seabird nesting and pelican roosting enhancements described under Alternative B are also included under this alternative. Approximately 140 acres of wetland and upland habitat would be restored within the Otay River floodplain and up to 440 acres of intertidal habitat would be restored within the salt works. In addition, under this alternative the public use program would be expanded to include additional opportunities for fishing and wildlife observation. The number of guided nature tours currently conducted within the salt works would increase. Solar salt production would continue, but within a reduced footprint.
- **Alternative D, Preferred Alternative: Expand Habitat Management, Enhance Nesting Opportunities, Maximize Habitat Restoration, and Provide Additional Public Use Opportunities** – Under this alternative, the habitat potential of the salt ponds would be maximized. Approximately 650 acres of existing salt ponds would be restored to tidal influence, with much of the restoration targeted for cordgrass-dominated salt marsh habitat. Approximately 33 acres of new seabird nesting habitat would be created and a managed water area of approximately 275 acres would be maintained within the existing pond system. About 45 acres of this ponded water area would be managed to create conditions favorable for brine invertebrates, a resource currently exploited by migratory birds such as phalaropes and eared grebes. The

nesting and roosting enhancements, described in Alternative B, and the restoration options for the Otay River floodplain, described in Alternative C, are also included as part of this alternative.

The existing public use program would be expanded to include opportunities for environmental interpretation, while also increasing opportunities for wildlife observation and photography. Fishing and boating activities would continue to be permitted within the bay, but the proposal to provide an opportunity for shoreline fishing, as proposed in Alternative C, would not be implemented under this alternative. Implementation of this alternative would result in the ultimate elimination of commercial solar salt production in the south bay.

## **2.2 Alternatives for the Sweetwater Marsh Unit**

### **2.2.1 Similarities Among Alternatives**

Although there are distinct differences among the range of alternatives developed for the Sweetwater Marsh Unit, a number of management components are common to all of the alternatives and would be part of the CCP regardless of the alternative selected for implementation.

#### **2.2.1.1 Features Common to All Alternatives**

Features common to all alternatives are summarized below. To reduce repetition in the alternative descriptions, those features that are common among all of the alternatives are described in detail only under Alternative A, No Action (refer to Section 2.2.2.1).

- *Annual Site Preparation at D Street Fill* – Each year, prior to the commencement of the California least tern and western snowy plover nesting season, approximately 30 acres at the western end of the D Street Fill would be disked or graded to remove weedy vegetation in preparation for seabird and shorebird nesting activity.
- *Monitoring of Listed Species* – Nesting activity and breeding productivity of California least tern and western snowy plover would be monitored annually per available funding at the D Street Fill. Annual surveys to monitor the light-footed clapper rail population on the Refuge would also be conducted.
- *Multiple Species Conservation Program (MSCP) Monitoring* – Annual monitoring would be conducted on the Refuge for salt marsh bird's beak and Nuttall's lotus (*Lotus nuttallianus*) in accordance with agreements made by the Service when the City of San Diego's MSCP was approved.
- *Light-footed Clapper Rail Captive Breeding Protocol Development Program* – The refuge staff would continue to be involved in the current efforts to develop captive breeding protocol for the light-footed clapper rail.
- *Invasive Plant Species Control* – Periodic control of invasive plant species would be implemented to enhance the quality of the native habitats on this Refuge Unit. The primary focus of this control would be in upland and upland transition areas.
- *Partnering in Debris and Litter Cleanup* – Periodic debris removal and litter cleanup would be conducted on the Refuge in partnership with other agencies and non-governmental organizations.

- *Management of Mitigation Leasehold Overlays* – The 83 acres of Refuge land currently encumbered by mitigation leasehold overlays (refer to Section 1.6.2) would continue to be managed in their current condition until these areas are restored by the leaseholder or the leaseholds expire. If the leaseholder proposes restoration for all or a portion of a leasehold overlay, the Refuge Manager would be responsible for reviewing and approving restoration proposals prior to their implementation.
- *Environmental Contaminants Coordination* – With assistance from the Service’s Division of Environmental Contaminants, Refuge staff would work with surrounding jurisdictions, adjacent property owners, and other affected state and local agencies to identify and, where applicable, remediate contaminated areas within the Sweetwater Marsh Unit and/or within adjacent parcels if Refuge resources could be adversely affected.
- *Protection of Cultural Resources* – Cultural resources would be managed in accordance with public law and agency policy. The Refuge Manager would continue to consider the effects of the proposed action on the Refuge’s archaeological and historic properties and would consult with the State Historic Preservation Office (SHPO), federally recognized Tribes, and interested parties prior to implementing any ground-disturbing projects.
- *Public Access Restrictions* – The public would continue to access the Refuge via a shuttle bus provided by and operated for the Chula Vista Nature Center at no charge to the riders. Once on the Refuge, public access to Gunpowder Point would be permitted via a designated trail system. All other areas within this Refuge Unit would remain closed to general public access.
- *Opportunities for Wildlife Observation and Photography* – Opportunities for wildlife observation and photography would be provided at the Chula Vista Nature Center, along a trail system on Gunpowder Point, and at the bird observation pavilion located near the southwestern corner of Gunpowder Point.
- *Environmental Education and Interpretation Partnerships* – Environmental education programs, such as the Sweetwater Safari, would be provided through partnerships with the Chula Vista Nature Center, the San Diego Zoological Society, and others. Opportunities for environmental interpretation would be provided at the Nature Center, as well as along a trail system on Gunpowder Point.
- *Facilitation of Appropriate Scientific Research* – Scientific research activities would be permitted with a Refuge Special Use Permit provided the activities are consistent with Refuge purposes and the mission of the NWRs.
- *Chula Vista Nature Center* – The Chula Vista Nature Center would continue to operate on the 3.3 acres of the Refuge set aside for this use when the Sweetwater Marsh Unit was established.
- *Fire Management* – The San Diego NWR Complex has developed a fire management plan for all of the Refuges within the complex. The plan, which is provided as Appendix L, emphasizes prevention and suppression as the primary fire management tools for this Refuge Unit. Fire prevention activities would include non-native brush

clearing along the eastern edge of the D Street Fill and around the Refuge office on Gunpowder Point.

- *Predator Management* – Predator management that focuses on reducing the adverse effects of predators on listed species, including the California least tern, western snowy plover, and light-footed clapper rail, would be implemented. A draft predator management plan is provided in Appendix M.

### **2.2.1.2 Features Common to All Action Alternatives**

These features are common to all of the action alternatives, but would not be implemented as part of the no action alternative.

- *Expanded Marsh Management* - Although the level of detail varies, each of the action alternatives includes a proposal to expand Refuge management activities within the marsh complex. These additional activities would be implemented to ensure the long-term protection of the marsh's species diversity and environmental health, while also implementing many of the measures included in Service-approved recovery plans for the light-footed clapper rail, salt marsh bird's beak, and California least tern, and the draft recovery plan for the western snowy plover.
- *Improvements to Tidal Circulation* – Both action alternatives include proposals that would improve tidal circulation within the Refuge's salt marsh habitat by removing fill material placed within the marsh prior to Refuge establishment; installing an additional culvert in the existing access road; and removing or lowering the weir at the south end of Paradise Marsh.
- *New Opportunities for Environmental Interpretation* – Under Alternatives B and C, the Service would work in partnership with the appropriate municipalities to develop and install interpretive signage in the public rights-of-way adjacent to Paradise Marsh and the F&G Street Marsh.

## **2.2.2 Detailed Description of the Alternatives**

### **2.2.2.1 Alternative A - No Action**

Under the no action alternative (Figure 2-1), the current management practices on the Sweetwater Marsh Unit would remain unchanged and existing public uses would continue at present levels. No new management practices or public uses would be initiated.

The Sweetwater Marsh Unit currently operates without an official management plan. Under the no action alternative, the current management activities would be incorporated into the CCP to formally establish ongoing management direction for this Refuge Unit for the next 15 years. Management direction is also guided by various laws, treaties and executive orders, applicable Service recovery plans, and the recommendations developed in association with ongoing migratory bird planning efforts. (For more information about applicable recovery plans and migratory bird planning efforts, refer to Section 3.4.1.3 and for specific legislative mandates and authorities, refer to Section 5.1.)

### **Wildlife and Habitat Management**

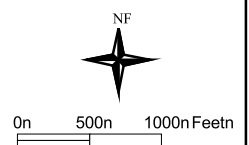
#### **Endangered and Threatened Species and Other Species of Concern**

Under this alternative, wildlife and habitat management activities would continue to focus on the protection and recovery of the federally listed endangered and threatened species





**Figure 2-1 Sweetwater Marsh Unit, Alternative A**



Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)

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supported on this Refuge Unit. Current management actions also provide benefits to state listed species, species identified as Birds of Conservation Concern, and species covered by the City of Chula Vista's Multiple Species Conservation Program Subarea Plan (2003).

California Least Tern and Western Snowy Plover: The portion of the D Street Fill (refer to Figure 1-3) that is included within the Refuge boundary consists of approximately 55.5 acres. The western end of the Fill would continue to be managed as nesting habitat for California least terns and western snowy plovers. When the Refuge was established, 25 acres in the western end of the Fill (12 acres of Port land and 13 acres of Refuge land) were set aside for protection and maintenance as least tern nesting habitat. Since that time, another 10 acres within the Refuge have been permanently designated as least tern nesting habitat. Under this alternative, annual site preparation would involve disking or grading approximately 40 acres at the western end of the D Street Fill prior to the nesting season. This activity would occur in partnership with the Port and would include preparation of both Refuge land and Port property.

Bi-weekly monitoring of nesting activity at the D Street Fill would also continue to be conducted per available funding from March through September of each year. Monitoring would involve the recording of nest locations, dates of nest initiation, pair number estimates, tallying of total nesting attempts, hatching success, chick banding, estimates of fledgling productivity, and incidental observations. At the end of each season, an annual report would be issued to summarize the year's monitoring results and, if necessary, suggest changes in management to improve fledgling productivity in subsequent years.

Predator management would continue to be implemented to reduce the loss of California least tern and western snowy plover adults, chicks, and eggs to mammalian and avian predation. (More information is provided below under Step-Down Management Plans.)

Light-footed Clapper Rail: Surveys of the light-footed clapper rail population within the Sweetwater River wetlands complex began in the early 1980s, prior to establishing the Sweetwater Marsh Unit. Since Refuge establishment, two types of surveys have been conducted to monitor the clapper rail population. A high tide survey is conducted between December and January of most years. Breeding call surveys are conducted between February and March of each year. Clapper rail surveys would continue under this alternative and the data obtained would be recorded and compared to data for other years and from other locations in Southern California in an effort to better understand the current status of the light-footed clapper rail throughout its range.

Salt Marsh Bird's Beak: Salt marsh bird's beak is included in the list of MSCP covered species prioritized for annual field monitoring, therefore, annual surveys to verify the presence and determine the size and location of the Refuge's salt marsh bird's beak populations would continue in accordance with the Biological Monitoring Plan for the Multiple Species Conservation Program (Ogden 1996). Annual monitoring of this species provides data necessary to assess both immediate threats and long-term population trends.

### **Management Activities**

Under this alternative, habitat management activities would include maintaining and enhancing existing habitat values for Refuge wildlife and plants. A step-down Habitat Management Plan (HMP) would be prepared to provide specific guidance for the implementation of habitat management strategies. Such activities would include trash and debris cleanups, periodic control of invasive plants, and enforcement of regulations



established to protect habitat values. Refuge staff would continue to support cleanups conducted in partnership with non-governmental organizations, such as the Port Tenants Association, which assists in the periodic removal of large debris from the marsh.

**Invasive Species:** Control of invasive species would focus on removing non-native terrestrial plants that invade the fringes of the high marsh and adjacent uplands. The most problematic species, including hottentot fig (*Carpobrotus edulis*), pampas grass, tree tobacco, fennel, myoporum (*Myoporum laetum*), garland chrysanthemum, giant reed, and tamarisk would receive the greatest attention.


**Mitigation Leasehold Overlays:** Approximately 83 acres of the Sweetwater Marsh Unit were designated as mitigation leasehold overlays by the Court when the Refuge was established. The locations of these overlays are illustrated in Figure 2-2. According to the Stipulated Settlement (refer to Section 1.6.2), the leaseholder may use, in whole or in part, any of the specified lands for wildlife habitat enhancement projects, upon approval of the Service. On March 27, 1998, the Service and Chula Vista Capital, the leaseholder of record at the time the MOU was signed, entered into an agreement that further refined the types of enhancement projects that would be appropriate for the mitigation leasehold overlay areas. The habitat types proposed for these areas are presented in Table 2-1.

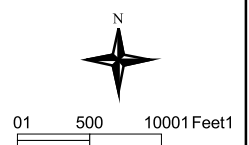
<b>Table 2-1</b> <b>Preferred Restoration Proposals for the Mitigation Leasehold Overlays</b> <b>Per the Approved Memorandum of Understanding</b>		
<b>Overlay Location<sup>1</sup></b>	<b>Preferred Habitat Type</b>	<b>Acres to be Restored</b>
D Street Fill	Intertidal wetlands	27.0 acres
Gunpowder Point	Intertidal wetlands or native uplands	7.5 acres
	Intertidal wetlands or freshwater wetlands	2.0 acres
	Native uplands	23.0 acres
F&G Street Marsh	Intertidal wetlands (salt marsh)	17.5 acres
Parcel 10g	Preservation/rehabilitation of wetlands	2.0 acres

The procedures for reviewing proposed enhancement projects are provided in the terms and agreements included in Exhibit 4 of the Agreement and Escrow Instructions, which were approved as part of the Stipulated Settlement. These procedures address when and how to submit a project to the Service for review and set forth the responsibilities of the Service and the leaseholder for processing and implementing an enhancement project. Table 2-2 outlines the procedures the Refuge Manager must follow when evaluating an enhancement proposal. All enhancement projects will require review under NEPA and the leaseholder would be responsible for any costs incurred by the Service in association with completing the NEPA process. The terms and agreements of the MOU remain in effect until 2010; therefore, restoration of the mitigation leasehold overlays could be implemented in accordance with the procedures outlined in Table 2-2 under this or any of the other alternatives until the MOU expires.



**Figure 2-2 Location of Mitigation Leasehold Overlays on Sweetwater Marsh Unit**

 Refuge boundary



Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)<sup>1</sup>

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**Table 2-2**  
**Review Procedures for Proposed Wildlife Habitat Enhancement Projects**

**Introduction:**

All wildlife habitat enhancement projects for lands covered by a leasehold interest are subject to approval by the Service. A wildlife habitat enhancement project is defined as a project that increases the habitat values for fish and wildlife resources by improving existing conditions or by creating new habitat types.

**Procedures:**

1. A written notice shall be provided to the Service of any proposed wildlife habitat enhancement project. This notice shall include a legal description of the property to be used for the project; a description of the proposed development requiring mitigation, if any; and a description of the wildlife habitat enhancement project, including a monitoring program and permit applications for any required Federal permits. If the leaseholder assigns its rights under the lease in whole or in part to another party, the notice shall also include the name, address, and telephone number of the assignee.
2. Within 60 days of receipt of the written notice and completion of the application, the Service shall render its decision regarding the proposal. The Service has an additional 10 working days to provide written notice of the decision to the applicant. Service approval of a proposed wildlife habitat enhancement project shall take into consideration the following criteria:
  - a. Implementation of the proposed enhancement project will:
    - Promote the protection, preservation, and conservation of an endangered or threatened species;
    - Improve habitat values on the refuge for migratory water associated birds and/or other trust resources;
    - Aid in developing wildlife and ecological conservation through increasing habitat values and/or providing for increased educational and passive recreational opportunities; and,
    - Aid in the management of wildlife and wildlands to obtain maximum benefit.
  - b. The proposed enhancement project is technically feasible.
  - c. The enhancement project, if proposed for mitigation, offsets impacts from development in the coastal areas of San Diego, Orange, and Los Angeles Counties.
3. The Service may require conditions of approval including, but not limited to, requirements that the project meet specified success criteria and/or the applicant post a performance bond to insure proper performance.
4. The applicant shall be responsible for carrying out all aspects of the enhancement project including obtaining all required permits and preparing the required NEPA document under Service direction.
5. The Service shall be responsible for approval and sign off of the final NEPA document and oversight of the enhancement project's final design and implementation.
6. The Service shall notify the applicant in writing via certified mail when the enhancement project is deemed complete.
7. On notification of completion, the applicant shall execute a quitclaim deed in favor of the United States for the area described in the legal description for the enhancement project.

Sources: Exhibit 4, Agreement and Escrow Instructions (US District Court 1988a)  
Chula Vista Mitigation Credit MOU (USFWS 1998)

All potential mitigation credits associated with these mitigation leasehold overlays expire in 2010, as stated in the 1998 MOU.

Captive Propagation Protocol Development Program for Light-footed Clapper Rail: Some of the ongoing activities associated with the captive propagation protocol development program for the light-footed clapper rail (refer to Section 1.7.2) occur on Gunpowder Point. Refuge staff along with a number of other partners participates in this program, which involves the captive propagation and release of juvenile clapper rails. Three large enclosures have been installed over an existing drainage on Gunpowder Point to house captive bred juvenile birds until they are ready for release. These activities would continue under this alternative.

### **Public Use Program**

#### **Public Access**

Under current conditions, public access on to the Refuge Unit is limited to Gunpowder Point, which can only be accessed via a shuttle bus operated by the City of Chula Vista. Due to the proximity of the access road to sensitive marsh habitat, foot and bicycle access to Gunpowder Point is prohibited. The remainder of the Refuge is and would continue to be closed to public use. The only exception involves approved research activities conducted under the auspices of a Refuge Special Use Permit.

The shuttle bus, which provides access to Gunpowder Point, is operated by the Chula Vista Nature Center and is currently available free for all uses. Visitors are transported to Gunpowder Point from an offsite parking lot located at the western terminus of E Street in Chula Vista. This parking lot is easily accessible via car from I-5 and is within walking distance of the E Street trolley stop. Public access onto Gunpowder Point is permitted when the Chula Vista Nature Center is open (generally, Tuesday through Sunday, 10:00 AM - 5:00 PM, except major holidays). Approximately 35,000 people visited the Nature Center and adjacent Refuge trail system during 2003. Other vehicular travel on the Refuge access road is restricted to Refuge and Chula Vista Nature Center staff and volunteers, school buses, and general delivery and maintenance vehicles serving the Refuge office and Nature Center.

#### **Wildlife-Dependent Recreational Uses**

The wildlife-dependent recreational uses currently permitted include wildlife observation and photography and environmental education and interpretation. Under the no action alternative, these uses would not be expanded and no additional uses would be provided.

Wildlife Observation and Photography: All opportunities for wildlife observation and photography are currently provided on Gunpowder Point. Specifically, these opportunities are provided within the Chula Vista Nature Center, from a bird blind situated near the edge of the bay along the Unit's southwest boundary, and along the existing interpretive trail that occupies the western end of Gunpowder Point (refer to Figure 2-1). From these facilities, Refuge visitors are able to observe migratory birds foraging within the adjacent salt marsh habitat and along tidal mudflats that border San Diego Bay. From the bird blind and some portions of the trail, visitors can also experience the sights and sounds of black brant (*Branta bernicla nigricans*), elegant terns (*Sterna elegant*), and other migratory birds rafting and foraging in the bay. Under this alternative, these opportunities for wildlife observation and photography would remain unchanged.

Environmental Education: The Sweetwater Marsh Unit provides the setting for a number of environmental education programs that benefit students from throughout the region, but particularly those students from schools in the surrounding cities of Chula Vista and National City. These programs represent a collaborative effort involving the Service, the Chula Vista Nature Center, other public agencies, and various non-profit organizations. Assistance is also provided through grants from private companies and state and local agencies. The Chula Vista Elementary School District participates in one program that focuses on a science and social studies curriculum. The program serves some 12,000 kindergarten through 12th grade students annually. Gunpowder Point provides the outdoor classroom for this program where students study topics such as the tides, water quality, native vegetation, and birds.

Sweetwater Safari is another program, jointly created by the San Diego Zoological Society, Chula Vista Nature Center, and the San Diego NWR Complex through a private grant to the Zoo's Habitat Conservation Education Department. This program, which meets the State of California's science standards for fourth grade, was created for students to learn about science and the local environment through a hands-on experience. The program includes on-site curriculum that is conducted on the Refuge and a post-visit curriculum that is conducted in the classroom. The on-site curriculum is taught by the teachers at Gunpowder Point. To lead the self-guided on-site program, the teacher must first participate in a training session conducted by Refuge staff, Chula Vista Nature Center staff, and other volunteer teachers. These training sessions are conducted quarterly at the Chula Vista Nature Center and are provided free of charge. Once a teacher has completed this training, he or she can arrange a time with the Nature Center to guide his/her class through the program. Equipped with backpacks containing relevant educational materials, the class travels along the 0.5-mile trail system on Gunpowder Point, gathering information about the many resources supported by the Refuge. The Refuge trails are flat, wide, and wheelchair accessible. Transportation grants to bring student onto the Refuge are available for this program.

Kimball Elementary School conducts another program in National City that is supported by the Refuge. This program generally occurs just upstream of the Refuge and presents a science and mathematics-based curriculum focused on the protection of watersheds, the function of wetland systems, and water quality testing.

Under this alternative, the Sweetwater Marsh Unit would continue to serve as an outdoor classroom and Refuge staff would continue to partner with various agencies and organizations to facilitate these programs. The Refuge would also continue to partner with the Chula Vista Nature Center, San Diego Zoo, Kimball Elementary, Paradise Creek Educational Park, Aquatic Adventures, and others to facilitate occasional field trips to the Refuge to support the organizations' desire to introduce students to the biological and cultural resources of the region, including the wildlife and plant resources found on the Refuge. The majority of these programs incorporate language arts, math, and social sciences into their curriculum in accordance with California State Education Standards. Several of these programs have been developed to reach the underserved youth of the region who have had little opportunity to experience the natural environment first hand.

Environmental education programs are conducted on this Refuge Unit once or twice a week throughout the year, with field trip opportunities open to only one classroom of approximately 32 students per day. Participants are generally transported to the site by



bus or van. In some cases, students arrive via the existing shuttle bus provided by the City of Chula Vista.

**Environmental Interpretation:** Interpretive panels installed along an existing half-mile trail system located on Gunpowder Point provide interpretation of the resources found on the Sweetwater Marsh Unit (refer to Figure 2-1). These panels offer general information about the wildlife and coastal habitats found in and around the Sweetwater Marsh Unit. Information about the Hercules Powder Company, which occupied a 30-acre site on Gunpowder Point between 1916 and 1920, is also provided along the trail. Interpretation of Refuge resources has also been incorporated into the interpretive themes of the Chula Vista Nature Center, which is described in greater detail below.

**Fishing and Hunting:** No opportunities for fishing and hunting are currently provided on this Refuge Unit and these uses would not be added under this alternative.

### **Other Public Uses**

**Chula Vista Nature Center:** Operated by the City of Chula Vista, the Chula Vista Nature Center is located on 3.33 acres within the Refuge Unit (refer to Figure 2-1) and was constructed on Gunpowder Point before the Refuge's establishment. When the Court conveyed Gunpowder Point to the Service as part of the Stipulated Settlement Agreement described in Chapter 1, it stipulated that the conveyance of the land would be subject to the existing 3.33-acre easement granted by the private landowner for the Chula Vista Nature Center. The Settlement Agreement also stipulated that the Nature Center would be permitted to utilize the Refuge access road for vehicle entrance and exit.

The Nature Center includes indoor and outdoor exhibits that interpret the resources and natural processes associated with San Diego Bay. There are several live animal exhibits, including an aviary that includes shorebirds commonly found in the area, as well as several breeding pairs of light-footed clapper rails. The Nature Center is an important partner in the Refuge's environmental education and interpretation programs, as described above. Several times a week, Nature Center docents lead small groups of people on interpretive walks along the Refuge's trail system. Although use of the interpretive trail system is available to the public free of charge, an admission fee is collected by the City of Chula Vista to explore the indoor and outdoor exhibits provided within the Nature Center. No changes to the operation of the Nature Center are proposed under this alternative.

**Walking Trail:** Approximately 0.5 miles of unpaved trails traverse Gunpowder Point providing access up to the edge of the bay (see Figure 2-1). This trail system was developed to facilitate the various wildlife-dependent recreational uses described above. All public access on this Unit is restricted to the Nature Center and this adjacent trail system. Post and cable fencing has been installed along the trail to discourage entry into adjoining sensitive habitat areas. No changes to the trail system would occur under this alternative.

**Research:** Opportunities for biological research have been provided at the Sweetwater Marsh Unit since its establishment. Several research projects have investigated the structure and function of salt marsh ecosystems, while others have involved research on a specific wildlife or botanical resource. All proposed research projects are reviewed for consistency with Refuge purposes and the mission of the NWRs. When deemed consistent, the researcher is issued a Refuge Special Use Permit. The permit may include conditions that the recipient must follow during research activities to avoid adverse

impacts to Refuge resources. Once the research is completed, the researcher is required to provide Refuge staff with the results of the research, including subsequent publications.

### **Environmental Contaminants Coordination**

Field observations, historic records of past land use activities, and limited soil and water sampling indicate that contaminants are present in several locations within the boundaries of the Sweetwater Marsh Unit. Present management of known and potentially contaminated properties generally involves coordination with the Service's Division of Environmental Contaminants, State and local agencies, and adjacent property owners. Currently, the Service is actively participating in projects related to two contaminated sites: Paradise Marsh, where an adjacent historic burn dump and other activities have impacted Refuge resources, and F&G Street Marsh, where contaminants from illegal dumping and runoff from upstream industrial uses are present in marsh sediments.

A Contaminant Assessment Process (CAP) has been completed for the Sweetwater Marsh Unit that documents and assesses the potential threats posed by environmental contaminants to Refuge lands and trust resources. The completed CAP prioritizes sampling and/or cleanup actions, recommends proposals for future investigations, and describes appropriate methods for initiating pollution prevention activities on the Refuge, as well as within the surrounding area.

### **Cultural Resource Management**

It is the policy of the NWRS to identify, protect, and manage cultural resources located on Service lands and affected by Service undertakings for the benefit of present and future generations. Several archaeological resources have been identified on the Sweetwater Marsh Unit, including archaeological and historic sites. The known archaeological sites on the Refuge were previously recorded, tested, and determined to be ineligible for inclusion on the National Register of Historic Places (NRHP). There is however a historic site on Gunpowder Point, the Hercules Powder Company historic site, that has not yet been evaluated for eligibility to the NRHP. Prior to the initiation of any actions that could affect this resource, this site must be recorded and evaluated in accordance with all applicable laws and regulations. Under this alternative, the Refuge Complex would continue to seek the funding necessary to complete the required site evaluation and cultural resource management plan for the Hercules Powder Company site.

Because undiscovered cultural resources may be present on the Refuge, any Refuge project that would result in the disturbance of the ground would require the completion of a cultural resource survey review and consultation with the SHPO, federally recognized Tribes, and interested parties. This requirement is applicable to all of the alternatives evaluated in the CCP.

### **Refuge Facilities**

The San Diego NWR Complex currently maintains a 1,500 square-foot Refuge office on Gunpowder Point (refer to Figure 2-1). The office is accessed via a gated road that extends from the terminus of E Street, near I-5, through undeveloped private land, and onto the Refuge. This roadway extends across Sweetwater Marsh on an improved road with two box culverts that facilitate tidal exchange between the bay and upper portion of the marsh.

Adequate parking for Refuge employees and Service vehicles is provided in a small, unpaved lot located across the primary access road to the east of the Refuge office.



Approximately ten vehicles can be accommodated in this lot. Limited additional parking is available immediately to the east of the Refuge office and about 50 yards to the south of the office.

### **Step-Down Management Plans**

Summarized below are two step-down management plans that have been prepared in association with the development of this CCP. The plans are presented in their entirety in the Appendices.

#### **Fire Management Plan**

The San Diego NWR Complex (Complex), consistent with the requirements of the National Fire Plan, has developed a fire management plan for all of the Refuges within the complex. The plan, which is provided as Appendix L, outlines the fire management objectives for the Complex, describes the Complex's wildland fire management situation, and presents the Complex's fire management strategies. With respect to Sweetwater Marsh Unit, the plan focuses on preparedness, wildland fire operations, prevention, and detection. Prescribed and wildlife fire use are not proposed as a strategy for achieving land management objectives on this Refuge.

Fire management plans prepared for Refuges are required to be consistent with firefighter and public safety, values to be protected, and natural and cultural resource management plans. These plans must also address public health issues. The Complex's draft fire management plan, which meets all of these requirements, also addresses potential wildland fire occurrences and includes a full range of wildland fire management actions, including containment, confinement, and control. The Wildland Urban Interface program under the National Fire Plan is used to fund hazard fuel reduction projects in areas where wild fire poses a risk to adjoining communities and refuge facilities. The Refuge staff developed, coordinated, and reviewed the draft plan to ensure consistency with the proposals included in the CCP for Sweetwater Marsh Unit. Once approved, the fire management plan will be supplemented by operational procedures such as a preparedness plan, preplanned dispatch plan, hazard fuel plan, and prevention plan.

Due to the on- and off-site values at risk on this Refuge, the fire management plan emphasizes prevention and suppression as the primary fire management tools. Fire prevention activities implemented on the Refuge occur in the vicinity of the D Street Fill and around the Refuge office on Gunpowder Point. Non-native vegetation growing along the eastern perimeter of the D Street Fill is periodically removed to reduce fuel levels. This activity is particularly important because of the ongoing risk of wildfires associated with illegal campfires started by vagrants in the area. The vegetation occurring immediately adjacent to the Refuge Office is also routinely pruned and thinned for structural protection.

#### **Predator Management Plan**

Predator management would continue to be implemented on the Sweetwater Marsh Unit pursuant to the Service's endangered species management responsibilities and in conjunction with other wildlife and habitat management activities provided adequate funding is available to cover the costs of this program. Currently, predator management on the D Street Fill is the joint responsibility of the Service and the Port, while predator management on the remainder of the Sweetwater Marsh Unit is the sole responsibility of the Service. Beginning in 2007 or 2008, depending upon when the National City Marina is opened, the Port will become responsible for all predator management activities occurring

on the D Street Fill and within Paradise Marsh between March 1 and September 15 of each year. This responsibility will continue for the life of the marina.

Predator management is necessary because predation has been identified as a serious limiting factor to the reproductive success of several federally listed species that nest on the Sweetwater Marsh Unit, including the endangered California least tern and light-footed clapper rail and the threatened western snowy plover. Predator management is implemented as part of an integrated wildlife damage control program that emphasizes non-lethal measures such as vegetation management, trash clean-up, the use of fencing and exclosures, and predator hazing or trapping and relocation, but also includes lethal removal of mammal predators. In addition, lethal removal of individual problem avian predators may be implemented when non-lethal measures prove to be ineffective. Predator management is one of several strategies implemented to protect from further decline the federally listed species found on the Refuge. The San Diego NWR Complex currently contracts with U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service, Wildlife Services (APHIS – WS) to accomplish predator management on the Refuge. APHIS – WS also conducts the Port's predator management program.

An important component of the Refuge's integrated predator management program is annual monitoring of least terns, snowy plovers, and light-footed clapper rails to determine hatch and fledge rates for terns and plovers, as well as adult breeding population size for all three species. In addition, tern and plover nesting areas and clapper rail habitat are monitored for the presence of avian and mammalian predators. Information recorded during monitoring includes predator species observed, particular behaviors and habits of an individual or group of predators, and evidence of predation on tern, plover, or rail adults, eggs, chicks, or fledglings.

The procedures for controlling predator species are dependent upon several factors, including but not limited to the degree of threat to endangered species populations, native or non-native status of the predator, the conservation status of specific predator species populations, and the condition of protected species nesting colonies. Based on these protocols, it has been determined that the following species are subject to control: domestic dog (*Canus familiarus*), domestic cat (*Felis domesticus*), feral dog, feral cat, coyote (*Canus latrans*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), California ground squirrel (*Spermophilus beecheyi*), Virginia opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), Norway rat (*Rattus norvegicus*), black rat (*Rattus rattus*), American crow (*Corvus brachyrhynchos*), common raven (*Corvus corax*), and injured gull species. In addition, individuals of the following native avian species could be live-trapped, or in some cases lethally removed, if an individual bird poses a threat to endangered species: American kestrel (*Falco sparverius*), loggerhead shrike (*Lanius ludovicianus*), barn owl (*Tyto alba*), great horned owl (*Bubo virginianus*), burrowing owl (*Speotyto cunicularia hypugaea*), short-eared owl (*Asio flammeus*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), peregrine falcon (*Falco peregrinus*), and some gull species. The presence of these native species within the Refuge is desirable, as they contribute to the Refuge's avian diversity, however, intervention to address specific problem individuals may be required to ensure the recovery of those species threatened with extinction.

The predator management plan emphasizes the use of non-lethal control measures whenever possible and the majority of the control actions occur during the endangered species nesting season. During the rest of the year, predator management focuses on the

control of feral dogs and cats and other mammalian predators that pose a threat to the endangered light-footed clapper rail, which is a permanent resident of the Refuge's coastal marsh habitat.

Some problem predators are live trapped and removed from the area. Live captured raptors and other avian predators that have been determined to pose a threat to listed species would be removed and held in a licensed/permitted rehabilitation or holding center until they can be released back into the wild. Release of these predators occurs at a suitable location after the endangered species nesting season is completed. Release site locations would be left to the discretion of the Refuge Manager. Prior to release, these predators would be banded with USFWS permanent leg bands.

Hazing might also be used to discourage predators from entering endangered species nesting areas. Lethal control would be implemented when non-lethal control proves ineffective and an individual problem predator is identified that poses an immediate threat to a listed species.

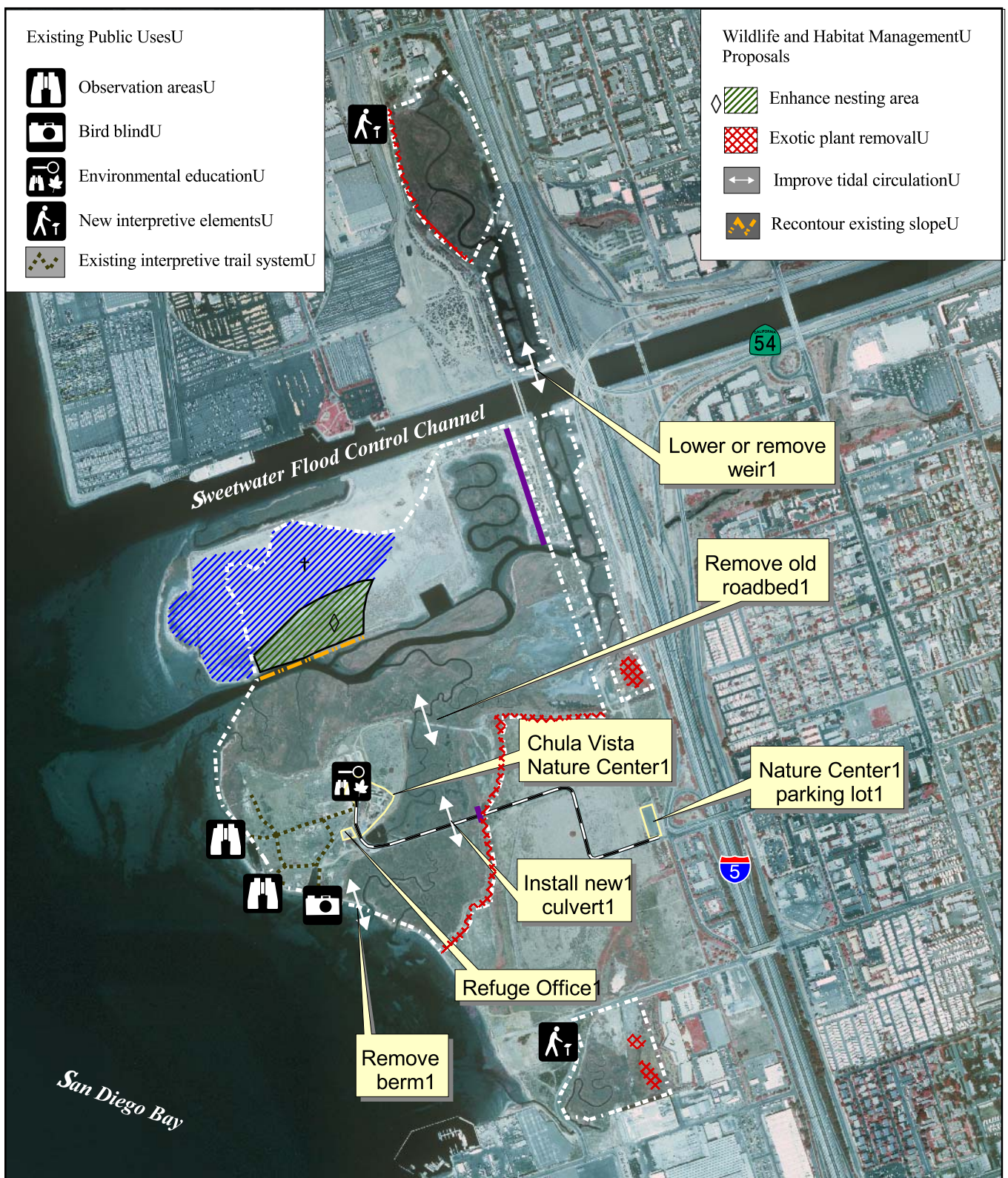
All domestic or feral dogs and cats, when feasible, would be taken to an approved shelter facility operated by a cooperating local unit of government, humane society, or a veterinary care facility. Any non-target wildlife (an animal determined not to be a threat to listed species) that is captured unharmed would be immediately released near the capture site or at a suitable location.

Specific control methods would be conducted in accordance with Federal and State regulations and are discussed in detail in the draft predator management plan provided in Appendix M.

### **2.2.2.2 Alternative B – Implement Habitat Enhancement**

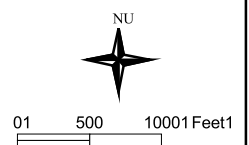
Under this alternative (Figure 2-3), management activities would focus on enhancing the Refuge's coastal salt marsh habitat for the benefit of a variety of wildlife species. Only a fraction of the salt marsh habitat that once existed within San Diego Bay still remains today, and the majority of that habitat is located within the Sweetwater Marsh Unit. It is essential that the biological diversity and environmental health of this habitat be maintained and, where appropriate, enhanced for the fish, resident or migratory wildlife, and plant species, that depend on this salt marsh habitat for survival. Improving the habitat value of the Refuge's coastal salt marsh habitat is crucial to the recovery of several federally listed endangered species, including the light-footed clapper rail and salt marsh bird's beak. Improving the habitat quality of Southern California's coastal wetlands is also a conservation priority of the Southern Pacific Shorebird Conservation Plan (*Hickey et al. 2003*).

In addition to the activities described under Alternative A, this alternative also includes proposals to enhance tidal circulation and improve marsh management, as well as a proposal to partner with adjacent cities in the development of interpretive elements for Paradise Marsh and the F&G Street Marsh. Full implementation of this alternative would require funding to construct the proposed circulation improvements and to design, construct, and install interpretive signs or other interpretive elements (refer to Appendix D).



**Figure 2-3 Sweetwater Marsh Unit, Alternative B**

- Refuge boundaryU
- Access roadU
- Gate/FencingU
- Jointly managed least tern nesting siteU



Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)1

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### **Wildlife and Habitat Management**

#### **Endangered and Threatened Species and Other Species of Concern**

In addition to the management activities described under Alternative A, the following additional activities would be implemented under Alternative B:

- Complete an inventory of the species present within the marsh complex and map the distribution and estimate the size of all populations of special status species in the marsh;
- Monitor sensitive plant populations to track changes in plant distribution and abundance, as well as changes in overall habitat quality;
- Identify locations in the marsh complex where appropriate conditions exist or could be provided to support salt marsh bird's beak;
- Develop protocols as part of a step-down HMP to reestablish salt marsh bird's beak in suitable locations within the marsh complex;
- Remove invasive plants throughout the Refuge Unit, as illustrated in Figure 2-3, placing particular emphasis on the removal of invasive plants in high marsh areas in order to create openings for seedling recruitment of salt marsh bird's beak and other native high marsh plant species;
- Improve signage and install fencing, where necessary, to minimize incidents of trespass into the marsh habitat to protect sensitive wildlife and plant species; and
- Increase tidal and seasonal freshwater circulation throughout the marsh complex, as described in greater detail in the Habitat Enhancement section.

#### **Habitat Protection**

Expanded Protection of the Refuge's Trust Resources: A public outreach program that increases understanding of and adherence to Refuge regulations is an important management tool for protecting the wetland and upland habitats of urban Refuges like the Sweetwater Marsh Unit. Under this alternative, a public outreach program would be developed and implemented that focuses on reducing the current levels of unauthorized access onto the Refuge. These would be achieved through improved signage along the Refuge boundary, greater numbers of public contacts by Refuge law enforcement, routine visits by Refuge staff to the more remote areas of the Refuge, and a broad based information campaign utilizing Refuge staff, our Friends group, and the media. If and when the open lands located immediately adjacent to this Unit are developed, the public outreach program would likely be expanded to address the potential increases in unauthorized entry onto Refuge lands, the presence of uncontrolled cats and dogs within the Refuge, and illegal dumping and littering within the Refuge boundaries. Should unauthorized access onto this Unit become significant, additional signage and/or fencing would be installed in appropriate locations to discourage such activities and public outreach would be expanded to more effectively reach the surrounding public.

Increased Involvement in Regional Planning Issues: The habitat quality of the wetland resources within the Refuge Unit is influenced to some extent by factors outside the control of the Service. Degraded water and air quality, night lighting, and excessive noise

levels generated from areas located outside of the Refuge can adversely affect Refuge resources. To reduce the potential for such adverse effects, the Service would increase its participation in local and regional planning efforts. Involvement in watershed planning, the development of regional growth management strategies, local development advisory committees, and other resource and development related planning activities would provide Refuge staff with opportunities to assist in developing policies that would minimize the effects of outside influences on Refuge resources.

### **Habitat Enhancement**

This alternative proposes several habitat enhancement projects intended to increase habitat values for a variety of species, particularly the Refuge's federally listed species, and several Birds of Conservation Concern, including the whimbrel (*Numenius phaeopus*), long-billed curlew (*Numenius americanus*), marbled godwit (*Limosa fedoa*), and black skimmer (*Rynchops niger*). These enhancement projects are described below and the location of each project is illustrated in Figure 2-3. The details of how and when these proposals would be implemented would be further defined in a future step-down HMP.

- Historic tidal channels in Sweetwater Marsh (channels that were blocked when fill was placed in the marsh to provide access to Gunpowder Point) would be reconnected to increase tidal circulation over approximately 60 to 80 acres of the main marsh complex, as well as to promote the expansion of cordgrass and improve overall habitat quality for the light-footed clapper rail. Specific actions include:
  - Removing some or all of the abandoned roadbed that currently separates the north and south ends of Sweetwater Marsh to reestablish old tidal channels in the eastern end of the marsh;
  - Installing an additional box culvert under the main access road to Gunpowder Point in an area where the road currently blocks a historic tidal channel; and
  - Removing an old berm constructed between the bay and the southern tip of Sweetwater Marsh if hydrological studies indicate that the tidal exchange in the back part of the marsh would benefit from this action.
- Portions of the D Street Fill would be enhanced to improve the suitability of the area for nesting least terns and snowy plovers. Specific actions would include:
  - Enhancing approximately 15 acres in the southwestern end of the D Street Fill to improve nesting conditions for least terns and snowy plovers by capping the area with six to eight inches of appropriate nesting substrate (sand and seashell fragments);
  - Removing all large perennials and shrubs that occur around the perimeter of the nesting area to reduce perching opportunities for avian predators and to eliminate cover for mammalian predators; and
  - Improving signage and installing fencing, where necessary, to minimize incidents of human and mammalian disturbance within the nesting area.
- A hydrological analysis would be conducted to determine the optimum design and weir height (if any) for the terminus of Paradise Creek, where it empties into the

Sweetwater flood control channel. Based on this information, the existing weir in this location would be lowered or removed to facilitate proper tidal flushing and natural channel maintenance in Paradise Marsh.

### **Public Use Program**

The uses currently occurring on Gunpowder Point, as described under Alternative A, would continue under this alternative. In addition, Refuge staff would seek to partner with National City and Chula Vista in the development of interpretive elements that could be accommodated within the public right-of-way adjacent to Paradise Marsh and F&G Street Marsh. There may also be an additional opportunity for interpretation on a proposed public trail to be installed on the bluff that overlooks Paradise Marsh.

### **Environmental Contaminants Investigations**

Under this alternative, funding would be sought to implement the recommendations included in the CAP (refer to Alternative A).

### **Cultural Resource Management**

Under this alternative, Refuge staff would continue to implement cultural resource management practices that are consistent with the requirements of the National Historic Preservation Act (NHPA). In addition, this alternative proposes to expand the Unit's existing interpretive program to include interpretation of the cultural history of the area, as well as the historic industrial uses that occurred on the site. These aspects of the interpretive program would be developed in partnership with federally recognized Tribes and other interested parties, including historical societies and museums. Finally, a Memorandum of Understanding (MOU) between the Service and the Tribes would be created and utilized to implement the inadvertent discovery clause of the Native American Graves Protection and Repatriation Act (NAGPRA). The MOU would address the process for identifying Native American Tribes, Groups, and direct lineal descendants that may be affiliated with the Refuge lands; initiating consultation with affiliated Tribes, Groups, and direct lineal descendants; developing procedures to follow for intentional and inadvertent discoveries; and identifying the persons to contact for the purposes of NAGPRA.

### **Step-Down Management Plans**

#### **Fire Management Plan**

All aspects of the fire management plan, as described in Alternative A, would also be implemented under this alternative.

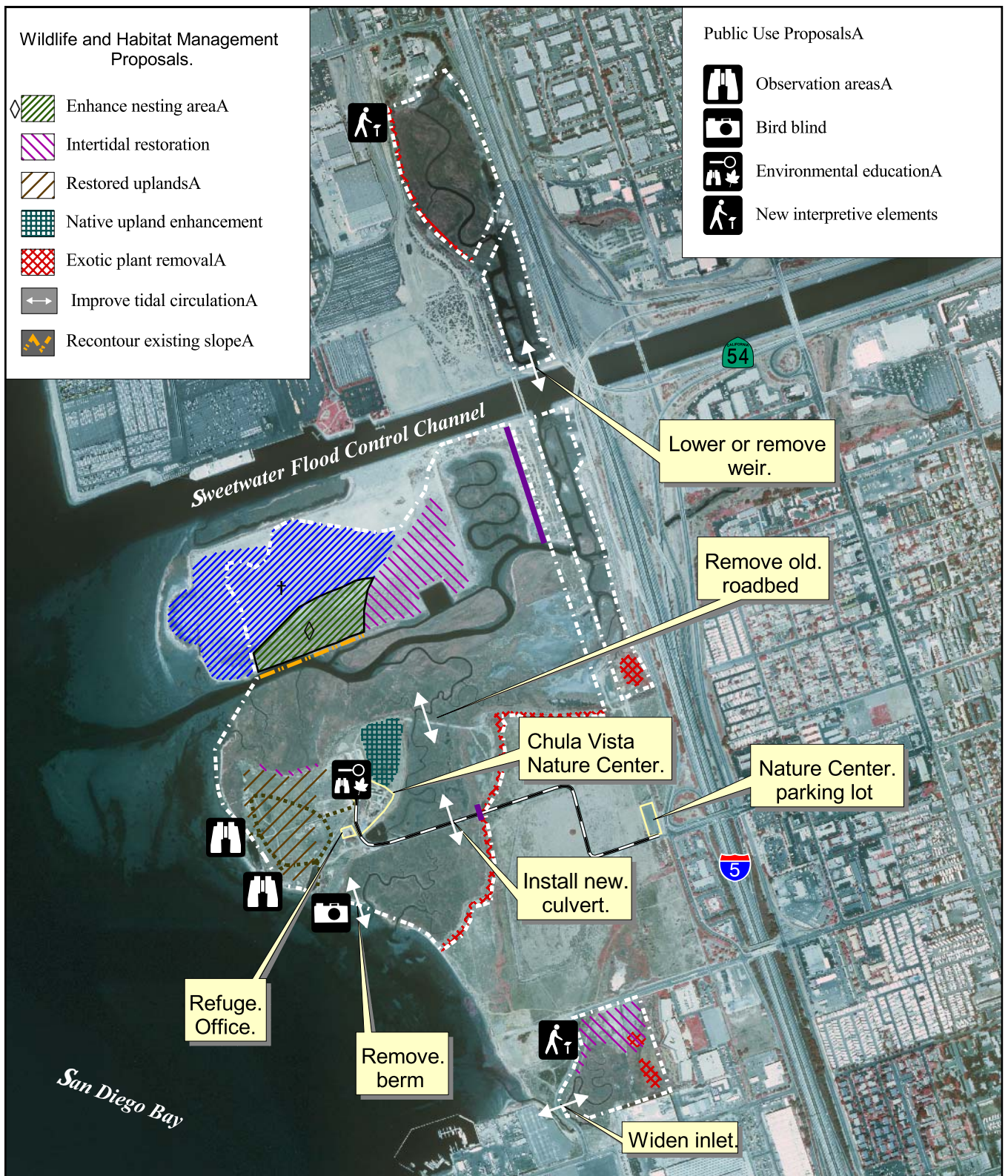
#### **Predator Management Plan**

Predator management, as described in Alternative A, would also be implemented under this alternative.

### **2.2.2.3 Alternative C – Preferred Alternative: Implement Habitat Enhancement and Restoration and Improve Existing Public Uses**

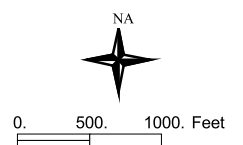
Under Alternative C (Figure 2-4), various restoration projects are proposed that would increase the total acreage and habitat quality of the salt marsh habitat on the Sweetwater Marsh Unit. In addition, native upland habitat would be restored on Gunpowder Point. This alternative also includes proposals for improving existing opportunities for wildlife observation, photography, environmental education, and interpretation. Full implementation of this alternative would require funding to implement the various habitat and public use proposals (refer to Appendix D).





**Figure 2-4 Sweetwater Marsh Unit, Alternative C**

- Refuge boundaryA
- Redesign interpretive trail systemA (Exact alignment to be determined)A
- Gate/FencingA
- Access roadA
- Jointly managed least tern nesting siteA



Source: USFWS, Local Agency Partnership 2000 (2 ft imagery).

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Restoring degraded areas within this Refuge Unit to habitats more reflective of historic conditions would implement recovery actions included in the California Least Tern Recovery Plan (*USFWS 1985a*), Salt Marsh Bird's Beak Recovery Plan (*USFWS 1985b*), Light-footed Clapper Rail Recovery Plan (*USFWS 1985c*), and Western Snowy Plover Pacific Coast Population Draft Recovery Plan (*USFWS 2001*). These restoration proposals would also implement some of the recommended actions for the conservation of shorebird populations in the South Pacific Region, as described in the Southern Pacific Shorebird Conservation Plan (*Hickey et al. 2003*).

### **Wildlife and Habitat Management**

#### **Endangered and Threatened Species and Other Species of Concern**

Management activities intended to support the Refuge's endangered and threatened species, as well as Birds of Conservation Concern, are described under Alternative B. Under this alternative, these activities would be expanded to include increased management within the marsh complex, while also restoring upland and wetland habitat. These proposals include:

- Seeking funding and/or partners to study the effects of recent sediment accumulation on the long term viability of cordgrass habitat within the marsh complex and identifying measures for improving the suitability (i.e. increasing the coverage and stem height of cordgrass) of the existing salt marsh for the light-footed clapper rails;
- Identifying appropriate areas for improving habitat quality for salt marsh bird's beak colonization; and
- Restoring coastal sage scrub and maritime succulent scrub habitat on Gunpowder Point, which could provide suitable nesting habitat for the federally listed threatened California gnatcatcher (*Poliophtila californica californica*), as well as improve habitat quality for native pollinators important to the Refuge's salt marsh bird's beak population; and restoring coastal salt marsh habitat to improve nesting and/or foraging habitat for several of the Refuge's listed bird species and other Birds of Conservation Concern (additional details regarding these restoration proposals are provided below under Habitat Restoration).

#### **Habitat Management**

The habitat management and protection proposals described in Alternatives A and B would also be implemented under this alternative. In addition, new and/or expanded maintenance and monitoring activities would be implemented for the first few years following restoration. These activities would include monitoring plant establishment in restored salt marsh habitat and controlling invasive plant species in restored areas. The costs and long-term staffing needs associated with these activities are addressed in Appendix D.

#### **Habitat Restoration**

This alternative includes various proposals for restoring the disturbed portions of the Sweetwater Marsh Unit to native habitat, as indicated in Figure 2-4. The restoration proposals as presented here are preliminary in nature. Detailed restoration plans would be developed as part of a subsequent step-down HMP. Table 2-3 provides an overview of the types of habitats proposed for restoration under this alternative and identifies the specific areas proposed for restoration.

Table 2-3 Habitat Proposals Under Alternative C		
Location <sup>1</sup>	Proposed Habitats	Estimated Acreage
<u>Sweetwater Marsh, Marisma de Nacion, Connector Marsh</u>	<u>Protected intertidal wetlands</u>	<u>170 acres</u>
	Possible conversion of high marsh to low marsh habitat ( <u>Sweetwater Marsh</u> )	To be determined
<u>Paradise Marsh</u>	<u>Protected intertidal wetlands</u>	<u>36 acres</u>
D Street Fill	Restored intertidal wetlands	13.0 acres
	Preserved nesting habitat	33.0 acres
	<u>Protected existing fish habitat site</u>	<u>1.0 acre</u>
	<u>Upland habitat to remain for access and sensitive plant protection</u>	<u>8.5 acres</u>
Gunpowder Point	Restored native uplands (coastal sage scrub/maritime succulent scrub)	25.0 acres
	Restored Intertidal wetlands	2.0 acres
	<u>Chula Vista Nature Center/Refuge Office Sites</u>	<u>8.5 acres</u>
F&G Street Marsh	<u>Enhanced Intertidal Wetlands</u>	6.0 acres
	Restored <u>Intertidal Wetlands</u>	<u>13.0 acres</u>
<u>Total Acreage</u>		<u>316 acres</u>

<sup>1</sup>Refer to Figures 1-3 and 2-4.

Sweetwater Marsh: Sweetwater Marsh has experienced reduced tidal and freshwater flows and increased sedimentation. In some areas this has resulted in the replacement of cordgrass-dominated low marsh habitat, a habitat important to the successful reproduction of the light-footed clapper rail, with high marsh habitat dominated by pickleweed. To reverse this trend, this alternative proposes the tidal enhancements described in Alternative B. By improving tidal circulation, the accumulation of sediment within the marsh would be reduced and in some cases reversed, which would improve conditions for cordgrass-dominated salt marsh habitat.

D Street Fill: Approximately 13 acres at the eastern end of the D Street Fill would be restored to intertidal habitat, while 33 acres, including about 10 acres, proposed for salt marsh restoration under the existing MOU (refer to Section 2.2.2.1), would be preserved for seabird nesting for at least the next 15 years. Another six to seven acres in this area would be set aside to accommodate access for maintenance and monitoring of the seabird nesting area and two acres would remain undisturbed to protect sensitive upland plants that occur along the western edge of Marisma de Nacion (refer to Figure 2-4). The

sensitive plants to be protected include Nuttall's lotus, coast wooly-heads (*Nemacaulis denudata*), and beach evening primrose (*Camissonia cheiranthifolia suffruticosa*).

Under this alternative, the restored intertidal area on the D Street Fill would be designed to include a mix of habitat types including tidal flats and subtidal areas. These habitats would provide foraging opportunities in proximity to tern and plover nest sites, and access to tidal flats from the adjacent nesting area would be designed and maintained to accommodate snowy plover foraging. Within the proposed nesting area, the substrate and other enhancements (fencing, signage, weed control) described in Alternative B would also be implemented under this alternative. All intertidal restoration would be designed with the intent of supporting the adjacent nesting terns and plovers.

Gunpowder Point: Both upland and wetland restoration are proposed for portions of Gunpowder Point (refer to Figure 2-4).

From about 1916 to 1988, the majority of Gunpowder Point was subject to significant human disturbance. First occupied for industrial purposes and later the site of a large agricultural operation, Gunpowder Point now supports vegetation characteristic of disturbed upland areas in coastal San Diego County. Based on the species composition of the small remnants of native upland vegetation that still exist on the site, it is likely that maritime succulent scrub once dominated portions of Gunpowder Point. Today, opportunistic native species representative of coastal sage scrub vegetation can be found lightly scattered throughout the more central portions of the site. These conditions indicate that Gunpowder Point would be appropriate for restoring areas of both coastal sage scrub and maritime succulent shrub habitat. Approximately 25 acres of disturbed habitat are available for such restoration.

The restoration of approximately two acres of coastal salt marsh is proposed along the northwestern edge of Gunpowder Point. The primary objective of this restoration proposal is to remove fill from the edge of the marsh that was placed there as a result of previous farming activities.

F&G Street Marsh: The disturbed portions of the F&G Street Marsh (approximately six acres) would be restored to improve habitat quality and tidal circulation (refer to Figure 2-4). This restoration proposal would involve the removal of uncompacted fill material located at the northeastern end of the marsh and along the east side of Marina Parkway. The proposed excavation would increase the tidal prism within the marsh, as well as provide appropriate elevations to support intertidal habitat. Following removal of the fill material, the restoration area would be contoured to produce a gradual change in elevation to support a range of intertidal habitats. Prior to implementing this proposal, it would be necessary to conduct a contaminants analysis to determine if contaminants are present and to identify appropriate methods for removing and disposing of contaminated materials excavated from this site.

Increasing the tidal prism within the F&G Street Marsh would improve tidal circulation to some extent; however, additional measures are required to improve the long-term wetland functionality of the marsh. Such measures include widening the existing tidal channel that connects F&G Street Marsh to San Diego Bay and replacing the existing undersized culverts in Marina Parkway with an open span bridge. Both of these proposals would involve improvements to properties located outside the boundaries of the Refuge;



therefore, their implementation would require cooperation between the Port, the City of Chula Vista, and the Service.

Paradise Marsh: The Service will continue to work with National City in their efforts to implement the National City Local Coastal Plan, which proposes restoration of native uplands adjacent to Paradise Marsh.

Note: The restoration proposals included in Alternative C address many of the areas currently encumbered by mitigation leasehold overlays, as described in Alternative A (refer to Section 2.2.2.1). Following the established of these overlays by the Court, the leaseholder and the Service entered into an MOU that specified the acreages, areas, and habitat types to be targeted for restoration within the overlays. Some of the restoration proposals described in Alternative C differ from those agreed upon in the MOU. Until the MOU expires, the leaseholder retains the authority to restore (following approval of the restoration plans by the Service), or sell mitigation credits to a third party who would restore, those areas included within the overlays in accordance with the MOU. Therefore, habitat restoration within the leasehold overlays cannot be initiated by the Service until the MOU either expires or is revised. Once the MOU expires in 2010, the Service would be free to restore any areas that have not been restored under the terms of the MOU. Although the Service may have to wait to implement restoration until the MOU expires, it still retains review authority of any leaseholder initiated restoration proposals to ensure that the terms of the MOU are met by the proposed restoration action.

### **Public Use Program**

#### **Wildlife-Dependent Recreational Uses**

Under Alternative C, the existing opportunities for wildlife-dependent recreational uses on the Sweetwater Marsh Unit would be improved and in some cases expanded. These uses include wildlife observation, photography, environmental education, and interpretation. No new public uses are proposed. As described in Alternative A, general public access onto the Refuge would continue to be restricted to Gunpowder Point. Visual access into other portions of the Refuge Unit, such as Paradise Marsh and F&G Street Marsh would be available from the existing public right-of-way. These areas provide opportunities for expanding the Refuge's current environmental interpretation program.

Wildlife Observation and Photography: Opportunities for wildlife observation and photography are available to the public via the existing trail system (refer to Alternative A). Under this alternative, the trail system would be redesigned to improve the quality of the observation opportunities on the Refuge (more details are presented below under Environmental Education and Interpretation).

In response to comments received during the public scoping process this alternative also includes a proposal to coordinate with adjacent municipalities (National City and Chula Vista) to develop opportunities for wildlife observation within the public rights-of-way that abut Paradise Marsh and the F&G Street Marsh (refer to Figure 2-4). No upland area is available on Refuge property to accommodate these observation areas; therefore, opportunities for observation points could only be provided from the existing sidewalk or roadway that adjoins Refuge property.

Environmental Education and Interpretation: The environmental education programs described in Alternative A would continue under this alternative. In addition, the Service would partner with other agencies and institutions in the region to support the creation of

and identify funding for a South Bay environmental education facilitator. This facilitator would be responsible for contacting school districts about the many field experience curricula available in the South Bay, including those on the Sweetwater Marsh Unit. This facilitator would also be responsible for developing a region-wide strategy for filling teacher workshops; soliciting transportation grants to be used by each program; and developing teacher in-service agreements with local school districts to more efficiently reach the greatest number of educators. The creation of such a position would enhance the outreach efforts of all existing environmental education programs in the South Bay, including the Sweetwater Safari and other programs implemented on this Refuge Unit.

There are a variety of opportunities available on Gunpowder Point for environmental interpretation (refer to Alternative A). Under this alternative, these opportunities would be maintained, and in some cases enhanced, to better serve Refuge visitors. Specifically, many of the interpretive panels provided along the half-mile trail system on Gunpowder Point (refer to Figure 2-4) need to be refurbished or replaced. In addition, the current alignment of the trail system does not adequately meet the needs of the Refuge's existing education and interpretation programs. To address this issue, this alternative includes a proposal to realign the trail system and redesign the existing interpretive elements provided along the trail.

The interpretive trail planning effort would involve evaluation of the existing trail system to determine where realignment of the trail would improve the quality of the trail experience, improve overall accessibility, and reduce potential impacts to adjacent sensitive habitats. Where possible, the trail would be designed to loop around an area, rather than bring a visitor out to the edge of a habitat and then terminate. The proposed realignments could involve the closure of some trail segments and/or the creation of one or more new segments. Although the redesigned trail system would be created primarily to facilitate environmental education and interpretive programs, it would also improve opportunities for wildlife observation and photography on Gunpowder Point. The redesign trail system would also be expected to reduce impacts to sensitive habitat areas by reducing the incidence of unauthorized off-trail activity. The specific details of these proposals would be developed as part of a step-down interpretive trail plan.

The step-down interpretive trail plan would also include proposals for new interpretive elements along the trail. This interpretation would be designed to complement existing educational programs, while also presenting a range of Refuge-related material for other visitors. The step-plan would include project designs, cost estimates for creating the various interpretive elements and redesigning the trail system, and appropriate locations for installing the interpretation along the redesigned trail. Once completed, funding would be sought to implement the plan. Implementation could occur in one phase or in various phases depending upon the availability of funds.

The proposal described in Alternative B to partner with National City and Chula Vista in the development of interpretive elements for the public right-of-way located adjacent to Paradise Marsh and F&G Street Marsh would also be implemented under this alternative.

### **Environmental Contaminants Investigations**

Similar to Alternative B, this alternative proposes to seek the funding necessary to implement the recommendations presented in the CAP.

### **Cultural Resource Management**

Cultural resource management under this alternative would be the same as described under Alternative B.

### **Step-Down Management Plans**

#### **Fire Management Plan**

All aspects of the fire management plan, as described in Alternative A, would also be implemented under this alternative.

#### **Predator Management Plan**

Predator management, as described in Alternative A, would also be implemented under this alternative.

## **2.2.3 Alternatives Considered but Eliminated from Detailed Study**

The alternatives development process is designed to allow consideration of the widest possible range of issues and potential management approaches. During this process, a variety of strategies for implementing Refuge objectives were considered. Some were eliminated because their implementation would have conflicted with other Refuge objectives. Similarly, several management actions were considered but rejected because they were either infeasible or failed to achieve Refuge objectives. Presented below are those alternatives that were considered but not selected for detailed study.

### **2.2.3.1 Expand the Refuge Boundary to Incorporate Adjacent Mudflats**

During the public scoping meetings, several individuals expressed a desire to see the Refuge boundary expanded to the west to incorporate the intertidal mudflats that currently border the Sweetwater Marsh Unit. Although this area is presently managed by the Port for conservation purposes in accordance with the Port Master Plan (*SDUPD 1998*), there was a feeling among some members of the public that the long-term preservation of this habitat would be better assured if the habitat was incorporated into the National Wildlife Refuge System.

The lands suggested for Refuge expansion are public trust lands held by the Port, with oversight from the California State Lands Commission, for the benefit of the people of California. Should this area be incorporated into the Refuge boundary, these public trust lands would not be transferred to federal ownership per California's Public Trust Policy. The CCP team reviewed this proposal and determined that expansion of the Refuge is not required to protect the habitats already included within the Refuge. In addition, these mudflats, which are already managed for habitat by the Port, would not receive any greater protection and management if they were to be incorporated into the Refuge. Based on the results of this review, a proposal to expand the Refuge boundary was not incorporated into one of the management alternatives for further review and analysis. The Service may determine at some future date that circumstances have changed and expansion of the Refuge boundary would benefit Refuge resources and/or the adjacent mudflats.

There is also an opportunity for the Service to enter into a cooperative agreement with the Port that would ensure the long-term protection of this area without the need to incorporate the area into the Refuge boundary. This opportunity is the result of an action taken by the Port in August 2001, when the Port Master Plan was amended to change the land use for the South Bay Boat Yard (a parcel located to the south of the Sweetwater Marsh Unit). As required in the Final Mitigated Negative Declaration for this project, the Master Plan Amendment includes the following condition: "... the Port District would enter into a cooperative agreement with an appropriate agency or organization which would be designated to protect and/or enhance, where appropriate,



the sensitive biological wetland habitat (i.e., mudflats) running north from the South Bay Boat Yard site to the Sweetwater River Channel.” To implement this condition, in November 2002 the Port wrote to the Service requesting direction regarding our interest in being a party to a cooperative agreement that would ensure the long-term management and protection of the adjacent mudflats. Discussions between the Port and the Service about this request are ongoing.

### **2.2.3.2 Open the Refuge to Recreational Fishing**

During the CCP process, the planning team evaluated the potential for opening the Sweetwater Marsh Unit to recreational fishing, as it is one of the six priority public uses of the NWRS. Following an analysis of the physical and biological conditions within this Refuge Unit, it was determined that access for shoreline fishing along the Unit’s tidal channels could not be provided without substantial degradation of sensitive wetland habitat. Even if fishing were to be permitted from non-motorized boats, the quality of the fishing experience in these areas would be limited because of the minimal size, depth, and availability of open water within the tidal channels.

As indicated in Figure 1-3, this Unit has almost no shoreline access along the bay. The land between the bay and open water is controlled by the Port. This is also true for the Sweetwater flood control channel. The small area of Refuge that does abut the bay at the southern end of Gunpowder Point is separated from the open waters of the bay by extensive areas of intertidal mudflats, which are managed by the Port.

Shoreline fishing is available in the immediate vicinity of the Refuge. Public fishing piers are provided to the north of the Refuge near Pepper Park in National City and to the south near the Chula Vista Marina in Chula Vista (refer to Section 3.6.4.2 and Figure 3-21 for more information). In addition, the bay is open to fishing year round.

The importance of the marsh habitat within the Sweetwater Marsh Unit to listed species was also considered in making this determination. The Sweetwater Marsh Unit protects one of the last remaining coastal salt marshes within San Diego Bay. This marsh habitat and its associated tidal channels provide regionally significant habitat for migratory shorebirds and is one of only a few places in San Diego County with suitable habitat for the federally-listed endangered light-footed clapper rail. Although some human disturbance in the main channel might be tolerated by the rail, the act of fishing would result in prolonged disturbance within the channel, which could diminish the habitat value of the tidal channel for the rail and various migratory birds.

After considering all of the issues outlined above, and taking into the consideration the other opportunities for fishing in San Diego Bay, the proposal to include recreational fishing on this Refuge Unit was eliminated from detailed study. For additional discussion, refer to the Compatibility Determination for Fishing on the Sweetwater Marsh Unit, provided in Appendix K.

### **2.2.3.3 Develop a Non-Motorized Boat Trail in Sweetwater Marsh**

Development of a seasonal water trail (a designated route through the tidal channels within the marsh for non-motorized paddle-type vessels) was considered but not included as an alternative component. This proposal would have opened a limited portion of the Sweetwater Marsh Unit to non-motorized, paddle-type vessels, such as kayaks and canoes, by establishing a seasonal (non-nesting season) kayak/canoe trail. Although recreational boating is not one of the six priority public uses of the NWRS, the water trail could have provided an opportunity for wildlife observation, as well as recreational boating. This public use component was not included within one of the three management alternatives for reasons related to species sensitivity and feasibility.

The Sweetwater Marsh Unit supports four federally-listed species that occur in proximity to the tidal channels that would accommodate this use. Of particular concern was the potential for increased human disturbance within the primary foraging areas of the light-footed clapper rail and western snowy plover. Other concerns related to potential landing of vessels along the high marsh areas that abut the channels. Such activity would result in trampling of sensitive plants, including salt marsh bird's beak, and would increase disturbance to light-footed clapper rails.

Feasibility issues included staffing limitations that would have made enforcement of the seasonal and non-motorized restrictions difficult and constraints associated with posting signs in the marsh to identify the approved route, as well as closed areas. Tidal conditions within the marsh also posed a potential safety issue as inexperienced paddlers could become stranded in the marsh during periods of low tide. A more detailed discussion of compatibility is provided in Appendix K, Compatibility Determination for Recreational Boating on the Sweetwater Marsh Unit.

#### **2.2.3.4 Alternative Predator Management Proposals**

Several alternative methods for addressing predation of listed species occurring with the San Diego Bay NWR were considered, but eliminated from detailed study. These methods, which are described below, included using only non-lethal measures for controlling predators (e.g., hazing, trapping); implementing only indirect controls, such as fencing nesting areas, installing anti-perching devices on posts and fences, and placing exclosures over nests, to reduce predator access to listed species; and implementing no predator management.

**Non-lethal Control Only.** Predator management that relies on the control of all predators using only non-lethal methods could have devastating effects on the Refuge's least tern and snowy plover populations. This is particularly true in situations in which an avian predator learns to prey on the eggs or young of a listed species. Past experience has demonstrated that once an individual predator successfully begins to forage within a least tern or snowy plover nesting colony, significant losses to the colony can occur before the individual is successfully trapped or otherwise discouraged from returning to the colony. In the case of predation of breeding adults, the losses have an even greater effect on productivity since losses of breeding adults can have adverse effects on least tern or snowy plover populations for many seasons. Without the option to implement lethal control when deemed necessary to protect listed species, it may not be possible to achieve the Refuge goals and objectives for the San Diego Bay NWR that relate to the protection of endangered and threatened species.

**Indirect Control Only.** Indirect control of predation would involve implementing management activities that reduce predation without lethal or non-lethal removal of predators. Instead, measures such as the use of visual and auditory repellents and physical barriers would be employed. Visual and auditory repellants are limited by several factors, including: 1) unintentional hazing of protected species while attempting to haze predatory species; 2) reduced effectiveness over time as some predatory species become accustomed to particular stimuli and begin to ignore them; 3) difficulties in effectively deploying such repellents in the field; and 4) limited effectiveness of repellents on particular species.

Physical barriers are a part of an integrated predator management program and would be implemented under the current predator management proposal, which should reduce the need for control of some mammals including unleashed and feral dogs. However, physical barriers in the absence of the ability to remove a predator are ineffective in controlling avian predation, as well as some mammalian predation. The use of exclosures over nesting plovers has been effective in protecting eggs, but once the chicks leave the exclosure, they are once again vulnerable to

predation. Although predation could be reduced to some extent through indirect control, the potential for loss, particularly from avian predators (refer to the discussion provided under Non-lethal Control Only) would remain high, therefore, this form of control is not considered adequate to achieve the goals and objectives of the Refuge for listed species.

**No Predator Management.** By taking no actions related to predator management, mammalian and avian predators would not be harassed or specifically deterred from traveling or flying through the Refuge or entering the nesting colonies. Based on previously documented losses of listed species to predation, it is likely that the Refuge's population of least terns, snowy plovers, and light-footed clapper rails would no longer be able to achieve sustainability goals for fledging success. In addition, a dramatic reduction in nest productivity could cause least terns and snowy plovers to abandon the existing nesting areas on the Refuge. A management strategy that excludes any form of predator management would place the viability of the Refuge's listed species at risk and would likely make it impossible to achieve the Refuge's endangered species goal.

## **2.2.4 Comparison of Alternatives by Issue**

Table 2-4 presents an issue-by-issue comparison of the three management alternatives for the Sweetwater Marsh Unit that were selected for detailed analysis.

## **2.2.5 Refuge Management Direction: Goals, Objectives, and Strategies**

### **2.2.5.1 Overview**

Goals and objectives are the unifying element of Refuge management, intended to identify and focus management priorities and to provide a link between management actions, Refuge purposes, and NWRS mission and goals. The goals for the Sweetwater Marsh Unit, as presented in Section 1.8.2.1, apply to all of the alternatives presented for the Refuge in the Draft CCP/EIS.

**Goals** are defined as descriptive, open-ended, and often broad statements of desired future conditions. **Objectives** are concise statements of what will be achieved to meet a particular goal. When possible, Refuge objectives should be specific, measurable, achievable, and result-oriented. In addition, objectives should be time-fixed within the 15-year life span of the CCP. Objectives derive from goals and provide the basis for determining strategies and monitoring Refuge accomplishments. **Refuge strategies** describe specific actions, tools, and techniques that can be used to meet Refuge objectives. In some cases, strategies describe specific projects in enough detail to assess funding and staffing needs. In other cases, further site-specific detail is required to implement a strategy. This additional detail takes the form of a step-down management plan, restoration plan, or site plan.

Although the goals are the same for each of the three alternatives described for the Sweetwater Marsh Unit there are a variety of ways in which to achieve these goals. Therefore, the objectives and strategies for each goal vary among alternatives. The following section includes objective statements and associated strategies for each Refuge goal. The objectives have been written to address the Preferred Alternative (Alternative C). In addition, the various strategies that would implement the objective in whole or in part are provided in a table format that allows the reader to determine which strategies would be implemented under each alternative. Specific acreage figures, time frames, and other measurable elements presented in the objectives may change depending upon which alternative is finally selected for implementation.

Table 2-4 Comparison of Alternatives for the Sweetwater Marsh Unit by Issue			
	Alternative A	Alternative B	Alternative C – Preferred Alternative
Issue			
<b>Wildlife/Habitat Management</b>			
<b>Enhance habitat values throughout the Sweetwater Marsh Unit</b>	<ul style="list-style-type: none"> <li>Continue current control of invasive plants in upland areas</li> <li>Maintain current public access restrictions in sensitive habitat areas to reduce disturbance by only permitting public access on Gunpowder Point</li> <li>Continue to conduct marsh clean ups with various partners</li> </ul>	<ul style="list-style-type: none"> <li>Implement projects to improve tidal circulation in Paradise Marsh and Sweetwater Marsh</li> <li>Expand invasive plant control to high marsh area to improve habitat quality for salt marsh bird's beak</li> <li>Enhance 15 acres of nesting habitat on the D Street Fill for terns and plovers</li> </ul>	<ul style="list-style-type: none"> <li>Implement the proposals included in Alternative B, plus increase the area maintained for nesting seabirds and western snowy plovers by 10 acres to a total of 33 acres on the D Street Fill</li> </ul>
<b>Restore native habitat, particularly salt marsh habitat</b>	<ul style="list-style-type: none"> <li>No restoration proposed (some mitigation may occur per the MOU for the mitigation leasehold overlays)</li> </ul>	<ul style="list-style-type: none"> <li>No restoration proposed (some mitigation may occur per the MOU for the mitigation leasehold overlays)</li> </ul>	<ul style="list-style-type: none"> <li>Restore 25 acres of intertidal wetlands, emphasizing restoration of cordgrass-dominated salt marsh habitat</li> <li>Restore 20 acres of upland habitat (coastal sage scrub and maritime succulent scrub)</li> </ul>
<b>Expand current marsh management activities to benefit listed species and migratory shorebirds</b>	<ul style="list-style-type: none"> <li>Maintain current management practices</li> </ul>	<ul style="list-style-type: none"> <li>Improve fencing/signage to reduce disturbance and reestablish salt marsh bird's beak in upland transition areas</li> </ul>	<ul style="list-style-type: none"> <li>Implement the proposals included in Alternative B and expand management/monitoring to include all restored areas</li> </ul>
<b>Reduce disturbance from adjacent urban development</b>	<ul style="list-style-type: none"> <li>Maintain current enforcement and surveillance levels</li> </ul>	<ul style="list-style-type: none"> <li>Develop a public outreach program to reduce unauthorized access into marsh habitat</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative B</li> </ul>

Table 2-4 (continued) Comparison of Alternatives for the Sweetwater Marsh Unit by Issue			
Issue	Alternative A	Alternative B	Alternative C – Preferred Alternative
<b>Wildlife/Habitat Management (continued)</b>			
<b>Address adverse effects of predation on listed species productivity levels</b>	<ul style="list-style-type: none"> <li>Implement a predator management plan to manage mammalian and avian predators at the D Street Fill to reduce losses of least tern and snowy plover adults, chicks, and eggs and in the marsh to protect light-footed clapper rails</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative A</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative A</li> </ul>
<b>Public Use</b>			
<b>Open the Refuge to fishing and boating</b>	<ul style="list-style-type: none"> <li>Maintain the current public use program which does not permit fishing or boating on the Refuge</li> </ul>	<ul style="list-style-type: none"> <li>Expanded public use program does not include opening the Refuge to fishing or boating</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative B</li> </ul>
<b>Expand opportunities for wildlife observation and environmental education and interpretation</b>	<ul style="list-style-type: none"> <li>Maintain the current public use program which includes opportunities for wildlife observation, environmental education, and interpretation</li> </ul>	<ul style="list-style-type: none"> <li>Partner with local agencies to develop interpretive signage for Paradise Marsh and F&amp;G Street Marsh</li> </ul>	<ul style="list-style-type: none"> <li>Expand interpretation as described in Alternative B</li> </ul> <p>Resign the trail system and interpretive signage on Gunpowder Point to improve wildlife observation, expand biological and cultural resource interpretation, and complement the existing environmental education programs</p>
<b>Other Issues</b>			
<b>Expand Refuge boundary to include adjacent mudflats</b>	<ul style="list-style-type: none"> <li>Maintain current refuge boundary, but work with the Port to protect mudflat habitat for migratory birds</li> </ul>	<ul style="list-style-type: none"> <li>Maintain current refuge boundary, but work with the Port to protect mudflat habitat for migratory birds</li> </ul>	<ul style="list-style-type: none"> <li>Maintain current refuge boundary, but work with the Port to protect mudflat habitat for migratory birds</li> </ul>

### 2.2.5.2 Description of the Goals, Objectives and Strategies

The proposed objectives and strategies are listed below as they apply to each of the five Refuge goals.

**GOAL 1:** Protect, manage, enhance, and restore coastal wetland and upland habitats to benefit native fish, wildlife, and plant species within the Sweetwater Marsh Unit.

#### ***Objective 1.1: Enhance Tidal Circulation in the Marsh Complex***

*When funding is identified, implement four enhancement projects intended to improve tidal circulation throughout the marsh complex to benefit approximately 130 acres of the Refuge's coastal wetlands. Implementation may occur in phases depending upon the availability of funding.*

**Rationale:** Historically, a network of tidal channels connected the marshes of the Sweetwater wetlands complex, including Sweetwater Marsh and Paradise Marsh. Over the years, the hydrology within these channels has been severely altered as a result of upstream dam construction, construction of the Sweetwater flood control channel, and filling within the marsh to accommodate access roads. As a result, freshwater flows into the marsh and tidal flushing throughout the marsh have been reduced, which has led to sedimentation within some of the marsh's tidal channels. Reconnecting some of these historic channels would improve tidal flushing, stabilize nutrient flows, and reduce the potential of further sedimentation within the channels. Improved tidal flushing would also restore appropriate salinity, pH, and oxygen content in marsh sediments, which is expected to improve conditions for cordgrass propagation. Implementation of this objective is consistent with the recovery actions described for the Sweetwater Marsh in the Light-footed Clapper Rail Recovery Plan (*USFWS 1985c*).

Objective 1.1 - Enhance Tidal Circulation in the Marsh Complex			
<i>Comparison by Alternative</i>			
<i>Alternative</i>			<i>Strategy</i>
<i>A</i>	<i>B</i>	<i>C</i>	
	✓	✓	Remove the abandoned roadbed that currently restricts tidal circulation between the north and south ends of the marsh to reestablish historic connections between the marsh's main tidal creek and the southern end of Sweetwater Marsh.
	✓	✓	Construct an additional culvert in Gunpowder Point Drive to reestablish a historic tidal channel and improve tidal circulation from the bay to the southeastern half of Sweetwater Marsh.
	✓	✓	Analyze previous hydrological studies that examined the effects of the weir located between the Sweetwater flood control channel and Paradise Marsh on tidal circulation and, based on this analysis, either lower or remove the weir to reduce tidal muting and improve overall tidal circulation in Paradise Marsh.
	✓	✓	Conduct a hydrologic study to analyze the benefits of removing the berm at the southern tip of Sweetwater Marsh; if benefits would be realized, prepare and implement engineering plans for removing the berm to improve tidal circulation within this portion of the marsh.

**Objective 1.2: Restore Intertidal Wetlands**

When funding is identified, restore approximately 20 acres of intertidal wetlands. Within five years of restoration, a minimum of 10 acres would be restored to cordgrass-dominated salt marsh at a density of at least 100 stems per square meter ( $m^2$ ) with at least 90 stems/ $m^2$  reaching a height in excess of 60 centimeters (cm) and of this, at least 30 stems/ $m^2$  reaching >90 cm in height (Zedler 1993). The remaining 10 acres of intertidal wetland restoration would consist of tidal channels and a combination of intertidal mudflat and cordgrass- and pickleweed-dominated salt marsh habitat.

**Rationale:** Statewide, 80 percent of California's coastal wetlands have been converted to urban or agricultural use (USFWS 1999). This loss of coastal wetland habitat has led to a decline of several native species that are now federally listed as threatened or endangered. Coastal wetland losses have also altered the abundance and distribution of shorebirds within the region (Hickey et al. 2003). Approximately 88 percent of the historic salt marsh habitat within San Diego Bay has been lost to dredging or filling (U.S. Navy 2000). Of the salt marsh that remains, the majority is preserved within the Sweetwater Marsh Unit. However, even within the Refuge boundary, historic uses have resulted in the loss of some salt marsh habitat. These disturbed areas provide opportunities for restoration that will benefit a range of coastal species. The salt marsh restoration is consistent with the Service's Biological Integrity, Diversity, and Environmental Health Policy and would implement recovery actions and conservation recommendations for the Refuge's listed species and migratory shorebirds.

Objective 1.2 - Restore Intertidal Wetlands Comparison by Alternative			
Alternative			Strategy
A	B	C	
✓	✓	✓	Prior to March 2010, review and approve, as appropriate, restoration and/or enhancement plans proposed for up to 50 acres of intertidal wetlands within the mitigation leasehold overlays.
		✓	Restore approximately 13 acres of the eastern end of D Street Fill to intertidal wetlands, of which a minimum of 10 acres would be restored to cordgrass-dominated salt marsh habitat.
		✓	Restore approximately six acres of disturbed fill area within the F&G Street Marsh to an appropriated array of intertidal wetland habitats.
		✓	Remove fill along the northwestern edge of Gunpowder Point to restore approximately two acres of salt marsh habitat.
	✓	✓	Establish and implement a monitoring program for the restored areas to determine if and how the restoration objectives are being achieved; make any necessary modifications based on these results.
	✓	✓	Employ integrated pest management techniques to control and/or eradicate invasive plant species within the restoration area.
		✓	Initiate a management oriented research project directed at identifying a scientifically accepted control technique(s) for the Australasian isopod <i>Sphaeroma quoyanum</i> that has invaded Sweetwater Marsh.
		✓	If and when a scientifically accepted control technique is identified for <i>Sphaeroma quoyanum</i> , implement this technique to control or eradicate this invasive species from the Refuge's intertidal habitats.



**Objective 1.3: Restore Native Upland and Upland Transition Habitat**

To restore the historic community structure of the wetland-upland transition within the Refuge, increase native species richness by at least 30 percent, increase native plant cover to 40 percent, and reduce perennial invasive plants to less than five percent cover along the marsh fringe over the next 15 years. Restore 25 acres of appropriate native upland scrub habitat on Gunpowder Point to achieve 50 percent cover of native perennial species such as flat-top buckwheat (*Eriogonum fasciculatum*), California sagebrush (*Artemisia californica*), lemonade berry (*Rhus integrifolia*), and California encelia (*Encelia californica*).

**Rationale:** The native upland transition habitat (refer to Section 3.4.2.2) that once existed between the upper edge of the Bay's tidal marshes and the adjacent upland vegetation has been almost completely eliminated as a result of urban development and human disturbance (U.S. Navy 2000). This habitat plays an important role in the life history of many avian species which depend on upland transition areas for shelter during high tide and adverse weather conditions. The native plants found in this habitat also attract native pollinators important in the pollination of salt marsh bird's beak. A few remnants of this habitat can be found around the perimeter of Gunpowder Point and Paradise Marsh, but in general, very little good quality native wetland-upland transition habitat remains. Fortunately, there are opportunities to restore native wetland-upland transition habitat on this Refuge Unit.

Objective 1.3 - Restore Native Upland and Upland Transition Habitat <i>Comparison by Alternative</i>			
Alternative			Strategy
A	B	C	
✓	✓	✓	Continue invasive plant species control along the periphery of the marsh to control invasive, non-native plants.
✓	✓		Review and approve, as appropriate, restoration plans proposed for up to 30 acres of upland habitat within the Gunpowder Point mitigation leasehold overlay prior to March 2010.
		✓	Determine an appropriate species composition for restoring upland (consisting of an appropriate mix of maritime succulent scrub and coastal sage scrub habitat) and wetland-upland transition habitat on Gunpowder Point. Complete the restoration plan for this area by 2010 and implement the plan when funding is identified for this project.
		✓	When funding for restoration is identified, restore 25 acres of upland and wetland-upland transition habitat on Gunpowder Point.

**Objective 1.4: Reduce Human Disturbance**

By 2008, develop and implement plans to reduce human disturbance in the Refuge's coastal salt marsh and upland transition areas by 90 percent over a period of one year, with the goal of reducing the need for contacts with offending individuals to no more than two per month.

**Rationale:** Human activity within sensitive habitats can cause significant disturbance to fish and wildlife, while foot and vehicle traffic can damage seedlings of sensitive plants. Human presence on the water or along the shore can disturb roosting and foraging birds, resulting in the expenditure of energy needed for migration. Various studies on the effects of wildlife disturbance have shown that general bird use decreases as frequency of disturbance increases (DeLong and Schmidt 2002). Human disturbance compounds the effects of habitat loss for many birds and other fish and wildlife that depend upon coastal wetlands for survival. Control

of human disturbance is a recommended action of the light-footed clapper rail and California least tern recovery plans and the Southern Pacific Coast Regional Shorebird Plan.

Objective 1.4 - Reduce Human Disturbance <i>Comparison by Alternative</i>			
<i>Alternative</i>			<i>Strategy</i>
A	B	C	
	✓	✓	Implement a public outreach program to reduce unauthorized access on the Refuge and increase public awareness of disturbance impacts by conducting public meetings, providing information to the media; installing appropriate interpretive signs, and contacting offenders.
	✓	✓	Coordinate with local agencies and landowners to develop effective measures for deterring residents and pets from entering the Refuge.
	✓	✓	Encourage local agencies to develop and implement appropriate grading, fencing, drainage, lighting, pedestrian/vehicular circulation, and other design standards for development proposed near the Refuge.

***Objective 1.5: Watershed Management Planning***

*Coordinate with State and local agencies working on management plans for watersheds affecting this Refuge Unit to assist in developing measures that would protect and restore functions and values of the Refuge's coastal wetlands when implemented.*

**Rationale:** Within San Diego's coastal watersheds, nine species are currently listed as endangered, two are listed as threatened, and at least fourteen are included on the Service's list of Birds of Conservation Concern. Some of these species, including the light-footed clapper rail, could be adversely affected over time by storm water pollution and urban runoff.

The storm water and urban runoff that flows through the Refuge and into San Diego Bay originates from throughout the watershed, traveling across a variety of jurisdictional boundaries. Water quality is influenced by numerous land use practices and these practices may be regulated differently in each jurisdiction. To account for these differences, efforts to implement effective measures for improving and protecting water quality throughout the watershed must be addressed at the regional level. The Comprehensive Management Plan for San Diego Bay (*San Diego Bay Interagency Water Quality Panel 1998*) suggests that through a watershed approach to land and resource management, consistent measures for addressing water quality can be developed and implemented, and recommendations for restoring and maintaining the physical, chemical, and biological quality of coastal waters and associated habitats can be developed. To ensure that this regional effort addresses the effects of water quality on the Refuge, the Service should take an active role in regional watershed planning.

Objective 1.5 - Watershed Management Planning <i>Comparison by Alternative</i>			
<i>Alternative</i>			<i>Strategy</i>
A	B	C	
✓	✓	✓	Participate in the development of watershed management plans for those watersheds the influence habitat quality in the Refuge.
		✓	Assist in identifying appropriate methods for stabilizing erosion within the watershed and preventing downstream sedimentation that could adversely affect coastal salt marsh habitat.

**GOAL 2: Support the recovery and protection efforts for the federally and state listed threatened and endangered species and species of concern that occur within the Sweetwater Marsh Unit.**

***Objective 2.1: California Least Terns and Western Snowy Plovers***

*Through a combination of nest site enhancement, monitoring and associated management actions, and improved access to restored foraging areas, maintain a 15-year average of at least one fledged chick per least tern nest with at least 100 least tern nests established annually within five years of implementing the proposed enhancements, and for snowy plovers maintain a 15-year average of one fledged chick per male snowy plover with at least 20 snowy plover nests established annually within five years of implementing the proposed enhancements.*

**Rationale:** Many of the historic nesting grounds once used by the California least tern and western snowy plover have been lost to intensive human encroachment along the coast, causing these species to seek nesting sites on mud and sand flats set back from the ocean. Six such nesting sites are intensively managed for these species in San Diego Bay, including the D Street Fill. Nesting success at D Street Fill has varied over the years, with least tern use increasing but productivity in need of improvement. Snowy plovers have not nested here since 2000. Factors influencing nesting success or failure include the number of predators present, the amount of nesting activity occurring in a given area, the presence or absence of appropriate nesting substrate, and access to appropriate foraging areas. On this site, providing support for successful tern and plover nesting requires predator and vegetation management, substrate enhancements (capping the nesting area with light sand and adding shell fragments to provide additional cover from predators), control of human disturbance, and improved access to intertidal areas for plover chicks. Such measures are consistent with the approved recovery actions for these species.

Objective 2.1 - California Least Terns and Western Snowy Plovers			
Comparison by Alternative			
Alternative			Strategy
A	B	C	
✓	✓	✓	Continue to partner with the Port in the annual site preparation of at least 30 acres of nesting habitat at D Street Fill.
✓	✓	✓	Continue to conduct predator management to reduce predation of snowy plovers and least terns during the nesting season.
✓	✓	✓	Continue to monitor nesting season activity, fledgling productivity, and type and extent of predation at D Street Fill, per available funding.
	✓	✓	Enhance the nesting substrate on about 15 acres of the D Street Fill by placing six to eight inches of light sand over the existing surface and spreading shell fragments on top of this sand cap.
		✓	Increase the area designated for nesting habitat on the D Street Fill by 10 acres and maintain this area to provide a total of 33 acres of nesting habitat on this Refuge Unit for at least the next 15 years.
		✓	Recontour the slopes along the southern edge of the D Street Fill to restore and maintain snowy plover access to adjacent foraging areas and design adjacent restored intertidal habitat to provide new foraging opportunities for plovers and terns in proximity to nesting areas.
	✓	✓	Reduce human and mammalian disturbance in the nesting area by improving fencing and signage where appropriate.

**Objective 2.2: Improve Marsh Management to Benefit Listed Species**

*Within five years of the CCP's approval, develop a Habitat Management Plan that includes measures to improve habitat quality for the light-footed clapper rail and salt marsh bird's beak within the 190 acres of intertidal wetland habitat on the Refuge.*

**Rationale:** A variety of recovery plans, migratory bird plans, and local multiple species conservation plans have been approved that address one or more of the marsh dependent species found on the Sweetwater Marsh Unit. Through the preparation of the HMP, the relevant recommendations and proposed actions included in these plans could be consolidated into specific management actions for this Refuge Unit. Specific recommendations for marsh management are included in the Salt Marsh Bird's Beak Recovery Plan (*USFWS 1985b*), while other species-specific recommendations are included in the recovery plans for the light-footed clapper rail and California least tern.

Objective 2.2 - Restore Intertidal Wetlands			
Comparison by Alternative			
Alternative			Strategy
A	B	C	
	✓	✓	Complete a native plant and wildlife species inventory and map the distribution of all special status species in the marsh by 2010.
	✓	✓	Develop and implement measures for protecting and managing at least 20 acres of high marsh habitat to support salt marsh bird's beak.

**GOAL 3: Protect and restore the environmental health of the Refuge's coastal salt marsh and upland habitats by making contaminants remediation a priority for Refuge lands, adjacent properties, and upstream developments.**

**Objective 3.1: Contaminants Management**

*Within three years of identifying a funding source, work with the Service's Division of Environmental Contaminants to develop and implement a baseline sampling plan for determining the extent and nature the Refuge's known or suspected containment areas, as identified in the CAP, and develop and implement a water quality monitoring program to characterize the quality of water entering the Refuge from upstream sources.*

**Rationale:** Environmental contaminants can result in fish kills, bird die-offs, developmental or reproductive abnormalities in many vertebrate species, and other instances of harm to fish and wildlife populations. Over the years, pesticides and other environmental contaminants have been contributing factors in the decline of populations of many bird species. Scientific analysis of the combined or synergistic impacts of specific combinations and concentrations of contaminants in the environment is limited. The U.S. Environmental Protection Agency does however provide some guidance regarding the level of remediation required to declare a site "clean" and free of unacceptable levels of toxic compounds.

The Service, which is one of several agencies that act as "trustees" for the nation's natural resources, has responsibility for NWRs, endangered and threatened species, migratory birds, and other natural resources. To address contaminants issues, the Service employs environmental contaminant specialists responsible for conducting field studies to determine sources of pollution, investigate pollution effects on fish and wildlife and their habitat, and investigate fish and wildlife die-offs. Sites typically assessed include those impacted by pesticides, industrial wastes, oil and hazardous waste spills, and other sources.

Preliminary analyses of several sites on the Sweetwater Marsh Unit indicate the presence of contaminants. These contaminants are associated with past and present industrial and agricultural activities occurring on or adjacent to current Refuge lands. The initiation of baseline sampling is required to fully assess the potential threat to Refuge resources posed by these contaminants. Depending upon the results of baseline sampling, more detailed contaminants investigations and/or clean up or remediation efforts could be warranted.

Objective 3.1 - Contaminants Management <i>Comparison by Alternative</i>			
<i>Alternative</i>			<i>Strategy</i>
A	B	C	
✓	✓	✓	Continue to work with the appropriate agencies/landowners to identify and remediate contaminant issues on Refuge and adjacent lands.
	✓	✓	Seek funding for, develop, and implement a baseline sampling plan based on the recommends included in the CAP.
	✓	✓	Identify funding to remove/remediate the polyethylene sheeting buried on Gunpowder Point.
	✓	✓	Seek funding to implement wet and dry weather water quality monitoring within the Refuge Unit. Monitoring should target surface waters entering from Paradise Creek, Bannister Creek, the Sweetwater River, and I-5 and SR-54 drainage channels.

***Objective 3.2: Spill Contingency Plan***

*By FY 2008, develop a site-specific contingency plan for the Refuge that provides Refuge staff with guidance on the safe and effective response to a hazardous substance spill within or upstream of the Refuge and includes a public outreach component to inform the public, appropriate agencies, and upstream landowners and businesses of the notification procedures that should be taken if a spill occurs upstream of the Refuge.*

**Rationale:** The Refuge is located at the bottom of the watershed that supports a variety of commercial and industrial uses. Several potential transport pathways have been identified in the CAP that could provide a pathway for hazardous materials from an accidental spill to enter the Refuge's sensitive coastal wetlands. To ensure that safe and effective responses are implemented in a manner that best protect fish and wildlife resources and their habitats in the event of a spill, it is essential that a spill contingency plan be developed for the Refuge. Spills are more easily contained in early stages and near the source. A contingency plan would facilitate prompt notification of appropriate staff and provide for the effective execution of containment and cleanup measures.

Objective 3.2 – Spill Contingency Plan <i>Comparison by Alternative</i>			
<i>Alternative</i>			<i>Strategy</i>
A	B	C	
✓	✓	✓	By FY 2008, complete a spill contingency plan for the Refuge and begin public outreach to ensure prompt notification in the event of a spill.
✓	✓	✓	Once funding is identified, characterize the baseline contaminants conditions on the Refuge to document pre-spill conditions.

**GOAL 4: Provide outstanding environmental education programs for all ages in partnership with the Chula Vista Nature Center and other public agencies and non-governmental organizations.**

***Objective 4.1: Environmental Education***

*Within six years of CCP approval, increase student/teacher participation in existing environmental education programs on the Refuge, particularly Sweetwater Safari, to 600 students per year.*

**Rationale:** The Sweetwater Safari environmental education program has generated considerable interest from the school districts in the immediate vicinity of the Refuge. The interest in this program is bolstered by the availability of private sector funding to cover the costs of transportation from the school to the Refuge. The program is viewed as a valuable tool in the region for educating students about coastal wetlands, ecological processes, and the natural environment. Many of the lessons included in this program are applicable to the variety of coastal wetlands currently being restored and protected in San Diego County and at present there is no other program like it in the country. It would be a logical next step in implementing the Refuge's environmental education program to expand the availability of this program to teachers and students throughout the region.

Objective 4.1 - Environmental Education			
<i>Comparison by Alternative</i>			
<i>Alternative</i>			<i>Strategy</i>
<i>A</i>	<i>B</i>	<i>C</i>	
✓	✓	✓	Continue to work with partners to support the variety of environmental education programs currently occurring on the Refuge.
		✓	Renew existing private partnerships and identify new partners to participate in providing free transportation for districts with limited or no transportation funding for field trips.
		✓	Redesign the existing Gunpowder Point trail system and accompanying interpretive elements to complement existing and planned environmental education programs.
		✓	Work with partners such as the Chula Vista Nature Center, San Diego Zoological Society, County Department of Education, and various school districts to develop a South Bay environmental education facilitator position within an appropriate county agency or organization.

**GOAL 5: Provide quality wildlife-dependent recreation, interpretation, and outreach opportunities to enhance public appreciation, understanding, and enjoyment of the Refuge's biological and cultural resources.**

***Objective 5.1: Wildlife Observation and Photography***

*As funding is identified, develop and implement a redesigned interpretive trail plan for Gunpowder Point that improves opportunities for wildlife observation and is better coordinated with the interpretive and educational programs occurring at the Chula Vista Nature Center.*

**Rationale:** Many visitors to the Sweetwater Marsh Unit are drawn by the opportunities available to observe the Refuge's diverse array of migratory bird species. Others visit in hopes of catching a glimpse of the elusive light-footed clapper rails that live on the Refuge year round. Wildlife observation and photography are two of the six priority public uses of the NWRs. Observation opportunities promote a broader public understanding of the value of natural resources and the need to conserve these resources. Every effort should be made to facilitate quality wildlife observation and photography opportunities, without compromising wildlife and habitat values.

Objective 5.1 - Wildlife Observation and Photography <i>Comparison by Alternative</i>			
<i>Alternative</i>			<i>Strategy</i>
A	B	C	
✓	✓		Continue to provide opportunities for wildlife observation and photography on Gunpowder Point by maintaining the existing interpretive trail system and bird blind.
		✓	Enhance the current opportunities for wildlife observation by incorporating observation areas into the new design for the interpretive trail to be prepared for Gunpowder Point.

***Objective 5.2: Environmental Interpretation***

*Within three years of identifying funding, design and install an updated interpretive plan for the redesigned trail system on Gunpowder Point. Coordinate this planning with the interpretive and educational programs occurring at the Chula Vista Nature Center and include interpretive elements that will reach a broader audience.*

**Rationale:** The Sweetwater Marsh Unit, which is situated within a highly urbanized metropolitan area, provides an excellent opportunity for visitors to escape the urban environment and experience the natural coastal resources that once dominated San Diego Bay. The Refuge's proximity to this urban area also provides the opportunity to interpret the mission of the NWRs and the many resources found on the Refuge. Interpretation should be expanded to more thoroughly address the Refuge's full array of natural and cultural resources. Interpretive elements related to early Native American activities around the bay are extremely limited. Gunpowder Point provides the opportunity to incorporate this history into the proposed interpretive program. There is also a need within the Refuge Complex to identify innovative ways to reach new and non-traditional audiences through expanded partnerships, cross-border activities, special events, and off-site programs.

Objective 5.2 - Environmental Interpretation <i>Comparison by Alternative</i>			
<i>Alternative</i>			<i>Strategy</i>
A	B	C	
✓			Continue to maintain the existing interpretive materials provided along the current trail system on Gunpowder Point.
✓	✓	✓	Continue to support the "Birds and Bikes" interpretive program developed by the Paradise Creek Educational Park, Inc.
	✓	✓	Develop an interpretive program for the F&G Street Marsh in partnership with the City of Chula Vista <u>that describes the importance of protecting coastal wetlands and the wildlife it supports.</u>



Objective 5.2 - Environmental Interpretation (continued)			
Alternative			Strategy
A	B	C	
	✓	✓	Develop an interpretive program for Paradise Marsh in partnership with the City of National City that is directed toward a younger, non-traditional audience and include multi-lingual interpretation.
		✓	Within three years of the CCP's approval, develop an interpretive plan for the redesigned trail system on Gunpowder Point that addresses natural and cultural resources and includes designs for new interpretive elements intended to reach new and non-traditional audiences.
		✓	Within six years of the CCP's approval, fabricate and install the various interpretive elements along the Gunpowder Point trail system.

***Objective 5.3: Cultural Resource Program***

*Implement proactive management of cultural resources that focuses on meeting the requirements of the National Historic Preservation Act, including consultation, identification, inventory, evaluation, and protection of cultural resources, and also on interpreting the archaeological and historic history of the lands now occupied by the Refuge.*

**Rationale:** It is the policy of the Service to identify, protect, and manage cultural resources located on Service lands and affected by Service undertakings, in a spirit of stewardship, for future generations. Cultural resources connect us to our past, providing the means to study and reflect upon the events and processes that have shaped our nation, our communities and ourselves. Many are unique and irreplaceable. Their true value rests in what they offer us in terms of scientific information, interpretive opportunities, and cultural identity. Cultural resources can provide important information about changes to our environment and landscapes over thousands of years. This information contributes directly to the Service's primary mission of managing wildlife and natural landscapes.

Through the interpretation of cultural resources the Service has the opportunity to help educate millions of refuge visitors each year about how humans interact with their natural environment and changes to landscapes over time. The management and protection of cultural resources is an important component of the goals for the San Diego Bay NWR, because of the cultural resources protected within the Refuge boundaries.

Objective 5.3 - Cultural Resource Program <i>Comparison by Alternative</i>			
Alternative			Strategy
A	B	C	
✓	✓	✓	Comply with all applicable cultural resource regulations and policies prior to implementing a project that would disturb any surface or subsurface cultural resources.
✓	✓	✓	Create and utilize a Memorandum of Understanding with Native American groups to implement the inadvertent discovery clause of the Native American Graves Protection and Repatriation Act (NAGPRA).
	✓	✓	Seek funding to survey, record, evaluate, and interpret the Hercules Powder Company plant site on Gunpowder Point according to the regulations of the NHPA.

Objective 5.3 - Cultural Resource Program (continued)			
Alternative			Strategy
A	B	C	
	✓	✓	Develop interpretive elements to describe the cultural history of the area by working with federally recognized Tribes and other interested parties, including historical societies and museums, and install these elements along the realigned trail.

## 2.3 Alternatives for the South San Diego Bay Unit

### 2.3.1 Similarities Among Alternatives

Although there are distinct differences among the range of alternatives presented for the South San Diego Bay Unit, the alternatives also include several features and management components that would be part of the CCP regardless of the alternative selected for implementation.

#### 2.3.1.1 Features Common to All Alternatives

Features common to all alternatives are summarized below. To reduce repetition in the alternative descriptions, those features that are common among all of the alternatives are described in detail only under Alternative A – No Action.

- *Monitoring of Listed Species* – Annual endangered species monitoring of nesting activity at the salt works would continue, per available funding. The focus of this monitoring effort is on the activities and nesting success of the federally listed endangered California least tern and threatened western snowy plover. Monitors also record nesting activity and productivity for the various species of colonial seabirds that annually nest on the levees. Periodic surveys would also be conducted within the Otay River floodplain to monitor the activities of the endangered light-footed clapper rail.
- *Multiple Species Conservation Program (MSCP) Monitoring* – Annual surveys to identify the presence of salt marsh bird's beak and/or Nuttall's lotus are conducted on the Refuge in accordance with the City of San Diego's MSCP.
- *Habitat Enhancement Related to the Cooperative Agreement between the Service and the Port* – Each alternative includes the implementation of the enhancement activities described in the Cooperative Agreement between the Port and the Service (refer to Section 1.6.3). These activities involve substrate enhancement (e.g. adding clean sand) on known and/or potential least tern nesting areas within the salt works and expanding current foraging opportunities for least terns within one or more of the salt ponds.
- *Invasive Plant Species Control* – Periodic control of invasive plant species, such as castor bean, tamarisk, giant reed, garland chrysanthemum, tree tobacco, and fennel, would be conducted within the Otay River floodplain.
- *Lease Additional Areas with the Acquisition Boundary* – The Service would continue to work with the Port, City of Chula Vista, and State Lands Commission to lease the remaining areas of the bay within the approved acquisition boundary for the protection and management of fish and wildlife.

- *Adjacent Land Use Coordination Activities* – The Service would continue to work with the surrounding jurisdictions (e.g. the cities of San Diego, Chula Vista, Imperial Beach, and Coronado, the Port, Airport Authority, U.S. Navy, and Caltrans) to ensure that adverse effects to Refuge resources from offsite activities are avoided or mitigated.
- *Environmental Contaminants Coordination* – With assistance from the Service’s Division of Environmental Contaminants, Refuge staff would seek funding to implement a contaminants site characterization for the Otay River floodplain and the salt ponds to determine if further investigations, and/or remediation are necessary.
- *Protection of Cultural Resources* – Cultural resources included within the Refuge would be managed in accordance with public law and agency policy. The Refuge Manager would continue to consider the effects of all proposed actions on the Refuge’s archaeological and historic properties and would consult with the SHPO, federally recognized Tribes, and interested parties prior to implementing any ground-disturbing projects.
- *Public Access Restrictions* – Public access onto the salt pond levees would continue to be restricted to guided nature tours or organized interpretive programs.
- *Opportunities for Fishing and Boating* – Fishing and boating within the open waters of the bay would continue to be permitted within the Refuge boundary in accordance with State fishing regulations and the 5 mile per hour (mph) “no wake” speed limit for all watercraft operating outside the main channel to the Chula Vista Harbor.
- *Wildlife Observation and Photography* – Opportunities for wildlife observation and photography would continue to be provided within the Refuge Unit.
- *Environmental Education* – The Habitat Heroes program would continue to provide environmental education opportunities for students in the vicinity of the Refuge.
- *Facilitation of Scientific Research* – Under any alternative, scientific research activities would be encouraged, provided the activities are consistent with Refuge purposes and the mission of the NWRS.
- *Fire Management* – The primary fire management proposals for the South San Diego Bay Unit, as described in the San Diego NWR Complex Fire Management Plan (refer to Appendix L), are suppression, prevention, and hazard fuel abatement in the Wildland Urban Interface. These proposals would remain the same under any alternative.
- *Predator Management* – The predator management plan described for the Sweetwater Marsh Unit would also be implemented on the South San Diego Bay Unit to reduce the adverse effects of predators on California least terns, western snowy plovers, and light-footed clapper rails. This predator management plan is presented in detail in Appendix M.

### **2.3.1.2 Features Common to All Action Alternatives**

The following feature is common to all of the action alternatives, but would not be implemented as part of the no action alternative.

- *Enhancement and Expansion of Nesting Opportunities* – A number of proposals would be implemented to improve nesting opportunities for the California least tern, western snowy plover, and other colonial nesting seabirds. These include enhancing nesting substrate on the levees, widening some levees, and managing the water levels in one or two ponds to provide new nesting opportunities for the western snowy plover.
- *Development of a Monofilament Recovery and Recycling Program* – A program modeled after the Monofilament Recovery & Recycling Program (MRRP) developed by the Florida Fish and Wildlife Conservation Commission would be implemented within the Refuge under all of the action alternatives.

## **2.3.2 Detailed Description of the Alternatives**

### **2.3.2.1 Alternative A - No Action**

The no action alternative (Figure 2-5) assumes no change to past and present management activities on the South San Diego Bay Unit. Under this alternative the management practices identified as necessary when the Refuge was established in 1999 would continue to be implemented and the public uses currently permitted would be maintained. In addition, commercial solar salt production would continue to operate on the Refuge under a Refuge Special Use Permit.

This alternative represents the baseline from which the other action alternatives for the South San Diego Bay Unit are to be evaluated. At present, the Refuge operates without a comprehensive management plan and no step-down plans have been prepared. Therefore, under this alternative, current management activities would be incorporated into the CCP to formally establish ongoing management direction for the Refuge for the next 15 years.

Despite the lack of a formal management plan, management direction for this Refuge is provided in the California Brown Pelican Recovery Plan (*USFWS 1983*), California Least Tern Recovery Plan (*USFWS 1985a*), the Light-footed Clapper Rail Recovery Plan (*USFWS 1985c*), and a number of national and regional bird conservation plans including the Southern Pacific Shorebird Conservation Plan (*Hickey et al. 2003*), the Riparian Bird Conservation Plan (*Riparian Habitat Joint Venture 2000*), and the draft North American Waterbird Conservation Plan Volume 1: Seabirds and Colonial Waterbirds (*North American Waterbird Conservation Plan Steering Committee 2001*).

Presented below is a detailed discussion of the management activities and public uses currently occurring within the South San Diego Bay Unit.

### **Wildlife and Habitat Management**

#### **Endangered and Threatened Species and Other Species of Concern**

Under this alternative, wildlife and habitat management activities would continue to focus on the protection and recovery of those federally listed endangered and threatened species that are supported on this Refuge Unit. These management practices also provide benefits to state listed species, Birds of Conservation Concern, and species covered by San Diego's Multiple Species Conservation Program Subarea Plan (1997).

**California Least Terns and Western Snowy Plovers:** The federally listed endangered California least tern and threatened western snowy plover both nest on the salt pond levees within the South San Diego Bay Unit. To improve nesting conditions on the levees, Refuge staff has been enhancing historic nesting areas by depositing a layer of sand over existing levee tops. This multiple year project began in 2002. The placement of six to



**Figure 2-5 South San Diego Bay Unit, Alternative A**



South San Diego Bay Unit  
Existing Management Authority



Solar salt production



Bike path



0.5 0.25 0.5 Miles

Source: 5USFWS, Local Agency Partnership 2000 (2 ft imagery)

Carlsbad Field Office - 20035  
/stem/stacey/ssdbay/fig\_4-03/figures.apr5

twelve inches of sand over the tops of these levees reduces the potential loss of chicks and eggs associated with the existing substrate conditions on the levees (refer to the Habitat Enhancement discussion below). Management of these species also includes annual monitoring of nesting success, implementing predator management (described in greater detail below), and enforcing access restrictions into the salt works throughout the year.

Weekly monitoring of nesting activity is conducted annually from March through September, utilizing Refuge staff, qualified contractors, and volunteers which are supervised by Refuge staff. Monitoring duties include recording nest locations, dates of nest initiation, pair number estimates; tallying of total nesting attempts; hatching success; chick banding; estimates of fledgling productivity; and incidental observations. At the end of each season, an annual report is issued that summarizes the year's monitoring results, evaluates current nesting conditions, and when appropriate suggests changes in current management practices to improve fledgling success for these species.

California Brown Pelican: The levee between Ponds 10 and 11 is a popular roosting area for California brown pelican. Current management actions to protect this roosting area include fencing and signage to discourage trespass onto the levees and active monitoring to ensure that unauthorized access onto this area does not occur.

Pelican roosting opportunities were recently expanded on the Refuge as a result of funding provided through the American Trader Final Restoration Plan. The specific project involved installing a floating platform in the salt ponds to provide isolated night roosting areas for the pelicans. The platform, which is anchored in place, is designed to range in size from 400 to 1,600 square feet depending upon the needs of the area. The facility is portable and can be relocated to another pond if necessary. Pelican activities on the platform will be monitored monthly for a period of one year to determine actual use by pelicans as a night roosting area. If monitoring results demonstrate positive benefits to the pelican, up to two additional platforms could be installed within the salt ponds.

Light-footed Clapper Rail: To better understand the current status of the light-footed clapper rail population within the South San Diego Bay Unit, an annual call-count survey is conducted between February and March of each year along the Otay River channel, one of the last remaining areas on the Refuge that supports habitat suitable for clapper rails. Predator management is also implemented year-round to avoid or minimize the loss of rails to mammalian predators.

Nesting Seabirds: The salt pond levees also provided nesting habitat for an array of colonial nesting seabirds, including the gull-billed tern, elegant tern, and black skimmer, all of which are listed by the Service as Birds of Conservation Concern (*USFWS 2002b*). These species benefit from the management actions being taken to protect the least tern and snowy plover and nesting productivity is noted for all seabird nesting activity during annual monitoring of the nesting colonies on the levees.

Beginning in March 2002, monitoring of nesting activity within the tern colonies was expanded to increase data collection related to the gull-billed tern. These additional monitoring responsibilities include recording gull-billed tern nesting productivity and foraging activity within the Refuge. Specifically, the location of nests, as well as the number and condition of gull-billed tern eggs, chicks, and adults, are recorded. Foraging preferences, including possible predation of listed species, are also monitored and recorded. The results obtained from these monitoring activities will assist the Service in



identifying additional research needs required to develop and refine an appropriate adaptive management program for the various seabirds that nest within this Refuge Unit.

### **Habitat Management**

Control of Invasive Plants: The primary habitat management activities conducted on the Refuge involve the control of weedy and non-native, invasive plants in the Otay River floodplain. Annually in the late winter or early spring, the abandoned agricultural fields within the Refuge are mowed or disked to reduce the total biomass of weedy vegetation, as well as to reduce weed seed production. In addition, manual, mechanical, and chemical control of non-native, invasive plants, such as giant reed, tamarisk, and castor bean, are periodically implemented to encourage the natural recruitment of native riparian species. The method chosen to control these species is based on the size of the infestation and the species of plant being controlled. A glyphosate based product containing no surfactant is used, when chemical control is determined to be the most appropriate means for controlling invasive plants. Chemical control is conducted only by individuals possessing a Qualified Applicator's License. Other activities include litter control and maintenance of gates and regulatory signage.

Salt Pond Management: Under existing conditions, the salt works is operated by a private commercial entity in accordance with the conditions of a Refuge Special Use Permit. Managing pond salinities, regulating the water levels in the ponds, and maintaining the levees are all the responsibility of the salt works operator. The conditions in the Special Use Permit restrict access to certain levees during the nesting season and establish seasonal controls on maximum water levels in some ponds that support migratory bird nesting. This alternative assumes that solar salt production would continue for at least another 15 years.

Although this alternative assumes the continuation of solar salt production, it should be recognized that the viability of this operation could be influenced by factors outside the control of the Service. For instance, the current operator may determine that salt production is no longer economically viable and decide to cease operations at the facility. There is also the possibility that the Airport Authority, which owns Pond 40, a portion of Pond 42, and the salt processing plant, may chose not to extend the current lease for solar salt production and/or sell its property when the current lease expires in 2007. If solar salt production were to be discontinued for any reason, the Service would have two options for managing the ponds in the absence of salt production: 1) continue to move water through the system until restoration planning is complete, or 2) immediately obtain the necessary approvals to breach the ponds and reestablish tidal action without altering the existing elevations within the ponds (refer to Alternative D, Scenario 3).

The implementation of either option would avoid excessive salinity increases within the closed system following the closure of the salt processing operation. Based on the experiences of the California Department of Fish and Game at the Napa River Salt Ponds in northern San Francisco Bay, inadequate water management can result in increased costs of moving the water through the system, lowered sediment and water column pH in parts of the system, and increased impoundment of sodium chloride and bittern salts within the ponds (*Siegel and Bachand 2002*). This situation would make future restoration much more difficult and expensive to implement.



### **Habitat Enhancement**

Two enhancement projects are to be implemented in accordance with the Cooperative Agreement between the Service and Port (refer to Sections 1.6.3 and 1.7.3). These projects involve improving the nesting substrate for the California least tern on the salt pond levees and expanding foraging opportunities, primarily for the least tern, within one or more of the salt ponds.

Enhancement of nesting substrate on the levees began in 2002 and would continue under this alternative. Per the Cooperative Agreement, the Port has provided \$150,000 to enhance a minimum of three acres of nesting habitat for the least tern. The Refuge Complex has also obtained additional funding and a donation of sand to expand substrate enhancement to improve nesting habitat for the range of seabirds that annually nest on the salt pond levees. This enhancement is necessary to improve seabird fledgling success. Monitoring has revealed that the existing substrate on many of the levee tops can cause a threat to small chicks when the surface becomes wet. Occasional light rain causes the silty substrate to become sticky and adhere to chicks' feathers and beaks, often resulting in death. This same condition can cause eggs to adhere to the surface causing the death of the developing embryo. This problem can be avoided by capping the levee tops with a layer of larger grained sand (ideally at a depth of six to twelve inches or more). Monitoring conducted following the first year of this enhancement project suggests that the enhanced levees are appealing to several species of seabirds that regularly nest on the levees.

The Cooperative Agreement also required the Port to provide \$50,000 to the Service to increase foraging habitat within the Refuge for least terns. Under this alternative, the \$50,000 would most likely be used to restore all or a portion of Pond 28 or 29 to shallow subtidal habitat. To achieve the desired habitat, the selected pond would be breached in order to restore regular daily tidal exchange within the pond. Assuming Pond 28 or 29 is selected; the pond would first be drained by moving the water from the pond into another portion of the salt works. Restoration would proceed by breaking up and/or removing the gypsum and salt crust from the bottom of the pond, creating a connection between the pond and the bay, and finally breaching the levee to allow bay water to flow into and out of the pond through daily tidal action.

### **Lease Additional Areas within the Refuge's Management Authority**

To ensure the preservation of those coastal habitats that support the listed species being conserved within this Refuge Unit, the Service would continue to work with the Port, City of Chula Vista, and State Lands Commission to secure management authority over much of the remaining open water areas included within the Refuge's approved acquisition boundary. Currently, the Service has management authority over approximately 955 acres of open water within the acquisition boundary (refer to Figure 1-5). Another 1,075 acres of open water within the acquisition boundary is managed by the Port, while the U.S. Navy owns and manages the remaining 35 acres of open water and associated intertidal habitat within the acquisition boundary. Extending the Service's management authority to those areas currently managed by the Port would ensure uniform enforcement of existing regulations. This action would also provide the Service with the opportunity to manage this area to benefit of the migratory and wintering birds that utilize the shallow bay waters within the acquisition area.

## **Public Use Program**

### **Public Access**

With the exception of periodic guided tours of the salt works, public access within the South San Diego Bay Unit is currently restricted to the open waters of the bay. No public access is permitted within the Otay River floodplain or within the salt ponds themselves. These access restrictions would be maintained under this alternative.

### **Wildlife-Dependent Recreational Uses**

Under the no action alternative, the wildlife-dependent recreational uses currently provided on the South San Diego Bay Unit would continue. These uses include fishing, wildlife observation, photography, and environmental education. No opportunities for environmental interpretation or hunting are currently provided, nor are they proposed under this alternative. Additional information regarding the Refuge's existing wildlife-dependent recreational uses is presented below.

**Fishing:** Fishing is an allowable use throughout much of San Diego Bay, including the open portions of the bay that occur within the management boundary of the South San Diego Bay Unit. San Diego Bay supports approximately 35,000 to 40,000 recreational angler days per year, with much of the fishing activity occurring from boats (*U.S. Navy 2000*). Due to the shallow water depths in the South Bay, which range from less than a foot near the intertidal mudflats at low tide to about eight feet in the shallow subtidal areas, the majority of the recreational fishing in San Diego Bay takes place outside the Refuge boundary in the northern half of the bay. Some recreational fishing is conducted within the Refuge boundary using motorized and non-motorized shallow draft vessels, such as rowboats, powerboats, canoes, and kayaks. With the exception of the main channel into the Chula Vista Marina, all boating activity in the South Bay is subject to the posted 5 mile per hour speed limit, which is enforced by the Harbor Patrol in accordance with the San Diego Unified Port District Code.

Fishing activities within the Refuge would continue under this alternative in accordance with the rules and regulations established by the California Department of Fish and Game (State). In addition, fishing would continue to be prohibited within the Refuge's salt ponds.

With the exception of the salt pond levees, the Refuge does not include any upland areas in the vicinity of the bay. Therefore, under this alternative all fishing within the Refuge would continue to occur via a boat or an appropriate floating device. No boat ramps are provided on the Refuge and none are proposed. There are several public and private boat ramps in the immediate vicinity of the Refuge, including public boat ramps in Chula Vista at Bayfront Park, near the Chula Vista Marina, and in National City at Pepper Park (refer to Section 3.6.4.2 and Figure 3-21 for more information).

Commercial fishing is also permitted in the bay in accordance with State regulations. The California Fish and Game Code (Code) requires commercial operations to obtain a commercial fishing license and permit or other entitlement to conduct commercial fishing operations in California. Although permitted by the Code, no commercial fishing operations are currently occurring in the South Bay. Scientific collecting of fish and other organisms could also occur provided the collector has a valid scientific collecting permit from the State. This alternative includes no recommendations to change the current recreational or commercial fishing regulations or scientific collecting operations established for the Bay.

**Wildlife Observation and Photography:** While the open bay portions of the South San Diego Bay Unit are currently available for public access, the adjacent intertidal wetlands and upland areas are closed. As a result, the current opportunities for wildlife observation and photography are provided either in the bay via watercraft or immediately adjacent to the Refuge along the Bayshore Bikeway or from the Biological Study Area. Opportunities for wildlife observation are also occasionally provided within the salt works via guided nature tours. These tours, which are conducted outside of the nesting season, provide the public with opportunities to observe the range of migratory birds that forage along the mudflats to the north of the salt ponds.

**Environmental Education:** An environmental education program entitled “Habitat Heroes” was implemented on the Refuge in 2003. This program began with funding provided through a challenge cost share grant. Funding for subsequent years has been provided from various public and private sources. Funding for 2005 is currently being sought. To establish this program as a permanent use would require a dedicated stream of funding that has not yet been identified. This program has been designed to develop an appreciation for the importance of coastal wetlands by incorporating the use of GIS technology, traditional and internet-based instruction, cross-age student mentoring and habitat-based investigations into the program. The program’s primary focus is to address the issues of invasive plants and storm water pollution. The outdoor activities associated with this program occur on an area of the South San Diego Bay Unit that is located immediately adjacent to the Bayside Elementary School (refer to Figure 2-5). It is here that students map native and nonnative plants, remove invasive plant species, and cultivate and plant native vegetation. Program implementation involves partnering with elementary, secondary, and post secondary students and teachers, volunteer groups, trained environmental educators, the City of Imperial Beach, and interested individuals from the surrounding community. In 2004, 220 students from Emory Elementary School participated in this program.

### **Other Public Uses**

**Recreational Boating:** Boating is an allowable use throughout much of San Diego Bay, including the open bay portions of the Refuge. Boating activities occurred prior to the establishment of the Refuge and have continued in accordance with U.S. Coast Guard and Port regulations. Motorized and non-motorized vessels are used in the open bay portions of the Refuge, as well as within the Otay River channel when permitted by the tides. Although boating is not one of the six priority public uses of the NWRS, boating can facilitate other wildlife-dependent uses such as fishing, wildlife observation, and wildlife photography.

Due to the shallow water depths within most of the South San Diego Bay Unit (i.e., one to eight feet), boating is generally confined to shallow draft vessels of various categories, including rowboats, powerboats, canoes, kayaks, sail boards, paraboarding, and personal watercraft. The current speed limit within much of the south end of the bay, including Refuge waters, is 5 miles per hour and is enforced by the Port. Under this alternative, the current uses and speed restrictions would remain unchanged.

**Research:** Although there are opportunities for biological research on the South San Diego Bay Unit, only a few research projects have been undertaken to date. Before a research project can be conducted on the Refuge, the Service must review the proposal for consistency with Refuge purposes and the mission of the NWRS. When deemed consistent, the researcher is issued a Refuge Special Use Permit. The permit may include

conditions that are to be followed during research activities to avoid adverse impacts to Refuge resources. Once the research is completed, the researcher is required to provide Refuge staff with the results of the research, including subsequent publications. No changes to the way in which research is conducted on the Refuge would occur under this alternative.

### **Other Uses**

**Solar Salt Production:** Commercial solar salt production has occurred in the South Bay for over 130 years. Prior to the establishment of the Refuge, the ponds were operated by Western Salt Company, owned by the H.G. Fenton Company (Fenton). Today, most of the salt ponds are owned by the State Lands Commission and leased to the Service for management as a National Wildlife Refuge. The Service's lease with the State permits the continued use of the salt ponds for salt production, provided that the Service determines that this use is beneficial to the operation of the Refuge for wildlife habitat purposes.

As described in Section 1.7.3, the Cooperative Agreement between the Service and the Port that resulted in the establishment of the South San Diego Bay Unit, required the Port to purchase most of the private lands on which the salt works is located. In addition, the Port purchased the lease that Fenton had with the State Lands Commission for the remainder of the salt ponds within the bay. Because the purchase was made using public trust funds, once purchased, the properties reverted to public trust lands, which are held in trust for the residents of California by the State Lands Commission. A few parcels within the salt works were not included within the approved Refuge boundary: the "Fenton Ponds" (Ponds 50 – 54), which were retained by Fenton for future use or sale; Pond 20A, which is currently owned by the Port; and Pond 40 and the northern portion of Pond 42, which are owned by the San Diego County Regional Airport Authority (Airport Authority).

When the ponds were sold, Fenton sold their interest in solar salt production to South Bay Salt Works, which currently operates the salt works under a lease with the Airport Authority and a Refuge Special Use Permit. The current lease and Special Use Permit expire on December 31, 2007.

The Refuge Special Use Permit that allows the ponds to be used for solar salt production includes a number of special conditions intended to protect endangered species and other trust resources that occur on the Refuge. These conditions include: annually closing certain levees within the system during the migratory bird nesting season (March 15 to September 15); restricting any changes to the current configuration of the system without prior approval by the Service; limiting brine shrimp (*Artemia sp.*) harvesting to Pond 23; and permitting the Service to implement certain habitat enhancement projects outlined in the Cooperative Agreement, as described previously. Under the current agreement, the salt works operator is responsible for the maintenance of the ponds, levees, water circulation system, and all other aspects of the operation.

In accordance with the Cooperative Agreement, the Port was to receive revenues from the lease of the salt ponds through the year 2009. After that date, the Service would receive any revenues generated from the lease of the salt ponds for solar salt production. Since the signing of the Agreement, changes in State law occurred that have redefined the responsibilities of the Port. Specifically, the Port's previous responsibilities for airport management were redirected to the Airport Authority, which assumed control and operation of San Diego International Airport and its interests in January 2003. Some of those interests include the salt process plant, Pond 40, and a portion of Pond 42. As a

result of this change, the Airport Authority is now entitled to receive any revenue generated from the lease of the salt ponds for solar salt production through 2009.

Salt is produced on the Refuge through a process of solar evaporation. The current facility consists of a series of diked ponds (Figure 2-6) that are designed to facilitate the concentration and ultimate precipitation of salts from bay water. Once seawater is taken from the bay, it is moved between the ponds through pumping and gravity flow.

The salt ponds are divided into four categories: the primary system, secondary system, crystallizer system, and the heavy brine or bittern ponds (refer to Figure 2-6). To produce salt, bay water is introduced into the primary pond system, through tide gates located between the Otay River and Pond 10. As the water moves through this primary system, it is transported from Pond 11 to Pond 12 via a 30-inch siphon pipe that extends under the Otay River. When appropriate salinities are achieved in Pond 15, the last of the primary ponds, the brine is lifted by pump to the secondary system. At the end of the secondary system are the pickling ponds. These ponds are used to distribute the concentrated brine into the crystallizer ponds. At about 310 parts per thousand (ppt), the brine is saturated with sodium chloride and bittern salts (more soluble salts and ions consisting primarily of chloride, magnesium, sulfate, potassium, and bromide) and is ready to be introduced to the crystallizer system. Precipitation of sodium chloride occurs within the crystallizer ponds; once the salt has precipitated out, the ponds are drained and the salt is removed and transported to the processing plant for cleaning and drying. For a more detailed description of this process refer to Appendix F.

Approximately 60,000 to 80,000 tons of common salt (sodium chloride) are produced each year at this facility. The salt is sold for use in water softeners; for nitrate removal, ion exchange, pickling, and deicing; as a dyeing additive; as brine for petroleum products; and for use in the tuna industry as a means of controlling brine temperatures. Another salt produced as a byproduct of solar salt production is magnesium chloride, which is purchased by several industrial users in the area. As currently operated, the facility requires no discharge permits.

The no action alternative presumes that commercial solar salt production would continue on the Refuge for at least the next 15 years. However, changes to the current salt pond configuration are required due to the impending loss of Ponds 50 through 54 from the system. These ponds are privately owned and outside the approved acquisition boundary for the Refuge, therefore, the Service has no control over this area. The removal of these ponds from the system requires reconfiguration of other ponds to accommodate the functions that currently take place in Ponds 50 through 54. The permits required to make these changes to the system have already been obtained.

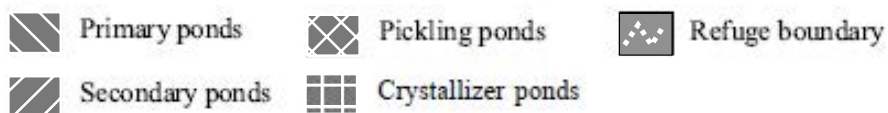
### **Environmental Contaminants Coordination**

A CAP has been completed for the South San Diego Bay Unit that documents and assesses potential threats posed by environmental contaminants to the lands, waters, and biota of this Refuge Unit. In addition, contaminant transport pathways and sources of contaminants are identified and potentially contaminated areas delineated. Taking into consideration the goals, objectives, and strategies outlined in the CCP, the completed CAP prioritizes necessary sampling and cleanup actions, recommends future investigations, and describes appropriate methods for initiating pollution prevention activities on the Refuge and in the surrounding area. Under this alternative, as well as all of the action alternatives, the recommendations of the CAP would be implemented when funds are identified to complete specific actions.

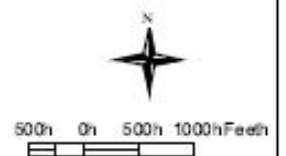




**Figure 2-6 Salt Ponds of the South Bay Salt Works**



Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)



Carlsbad Field Office - 2003  
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### **Cultural Resource Management**

It is the policy of the NWRs to identify, protect, and manage cultural resources located on Service lands and affected by Service undertakings for the benefit of present and future generations. The South San Diego Bay Unit has been the subject of several cultural resource surveys; however, a complete survey of the Refuge has not yet been completed. The salt works is one historic resource that has been identified within the Refuge. This property was previously evaluated by the City of San Diego and has been deemed eligible to the NRHP.

A cultural resource survey would be conducted prior to implementing projects on the Refuge that involve ground disturbing activities. Any resources identified during the survey would be evaluated for eligibility to the NRHP and consultation would be completed with the SHPO, federally recognized Tribes, and interested parties. Any changes to the salt works would also require consultation with the SHPO. (For more information regarding cultural resources, refer to Section 3.5.)

### **Refuge Facilities**

With the exception of boundary markers and some access gates, no Refuge-related facilities such as offices or outbuildings are present within the South San Diego Bay Unit. Refuge management occurs out of the offices on the Sweetwater Marsh Unit, the Tijuana Slough NWR, and the San Diego NWR Complex in Carlsbad.

To ensure long-term access into the salt works, an agreement with one or more of the property owners to the east of the Refuge would be sought to establish a permanent easement for required management and maintenance activities, as well as to facilitate periodic guided nature tours from the public right-of-way into the salt works.

### **Step-Down Management Plans**

#### **Fire Management Plan**

Fire management on the South San Diego Bay Unit is addressed in the fire management plan prepared for the San Diego NWR Complex (Appendix L). In addressing this Refuge, the plan focuses on preparedness, wildland fire operations, prevention, and detection. Prescribed and Wildlife Fire Use is not proposed as a strategy for achieving land management objectives on this Refuge.

The primary elements of the fire management plan for the South San Diego Bay Unit include suppression, prevention and hazard fuel abatement in the Wildland Urban Interface. The primary fire prevention and hazard fuel abatement activity implemented on the South San Diego Unit is the annual mowing of the abandoned agricultural fields within the Otay River floodplain. In addition to hazard fire abatement, routine monitoring of the area by law enforcement staff is conducted to discourage illegal encampments, thereby reducing the potential for wildland fires on the Refuge.

#### **Predator Management Plan**

Under this alternative, predator management would continue to be implemented on the South San Diego Bay Unit pursuant to the Service's endangered species management responsibilities and in conjunction with other wildlife and habitat management activities. Predator management is necessary to conserve the least tern, western snowy plover, and light-footed clapper rail populations supported on this Refuge Unit. Predator



management would be implemented as described in Alternative A for the Sweetwater Marsh Unit (refer to Section 2.2.2.1). The draft predator management plan is provided for review in Appendix M.

### **2.3.2.2 Alternative B – Expand Habitat Management and Enhance Nesting Opportunities**

Alternative B (Figure 2-7) focuses on expanding and improving habitat within the salt ponds for nesting seabirds and shorebirds. The elimination of vast areas of historic nesting and foraging habitat along the California coast has elevated the need to protect and manage nesting areas, such as those on the salt pond levees. Providing viable nesting sites is essential to the recovery of endangered California least tern and threatened western snowy plover.

Under this alternative, nesting habitat for least terns and the other seabirds that nest at the salt works, including gull-billed terns, elegant terns, and black skimmers, which have been identified by the Service as Birds of Conservation Concern, would be enhanced; new nesting opportunities for the western snowy plover would be provided; and various habitat management activities would be implemented to improve habitat quality throughout the Refuge. No changes to the current public use program would occur under this alternative. All other activities and programs currently being implemented on the Refuge as described in Alternative A would continue, including commercial solar salt production.

#### **Wildlife and Habitat Management** **Habitat Enhancement**

The management activities proposed to enhance nesting opportunities within the salt works include recontouring some levees to reduce steep side slopes; applying appropriate nesting substrate to the tops of the recontoured levees; and expanding the area available for nesting by widening some levees and filling portions of some ponds. The specific locations of the various enhancement components, the extent of work to be completed, and the final size and configuration of the nest sites would be determined during subsequent step-down planning. In designing these sites, current use patterns, the demonstrated need to improve existing conditions, and an evaluation of optimal habitat values for fish and affected bird species would all be considered. As described in Section 2.3.2.1, some substrate enhancement is being conducted now, but not to the degree envisioned under this alternative.

Recontouring the side slopes of the levees is proposed to improve conditions for chicks, particularly western snowy plover chicks. The steep, eroded side slopes of the levees would be replaced with a maximum 4:1 side slope as shown in Figure 2-8. Improving the side slope gradient would increase foraging access for shorebird chicks and adults, which feed on the brine and benthic invertebrates that occur at the edge of the ponds. Slope recontouring would be accomplished primarily by adding additional soil along the edges of the levees and creating a new slope. In some cases, it may be possible to regrade the existing levees using manual labor or a small tractor to lower and narrow the levee surfaces. The material that is generated would then be used to reshape the side slopes. Once the side slopes have been prepared, a six to twelve-inch layer of light colored sand would be placed on the levee surfaces.

Estimates of the amount of fill material and sand required to recontour those levees depicted in Figure 2-7 is presented in Table 2-5. The estimates were developed based on the assumption that all recontouring would be accomplished using imported fill and are provided to facilitate an analysis of the potential effects of implementation. The actual




**Figure 2-7 South San Diego Bay Unit, Alternative B**

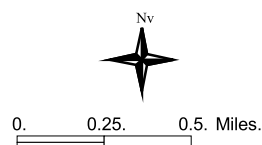
 South San Diego Bay Unit  
Existing Management Authority

 Boating

 Fishing

 Environmental  
education

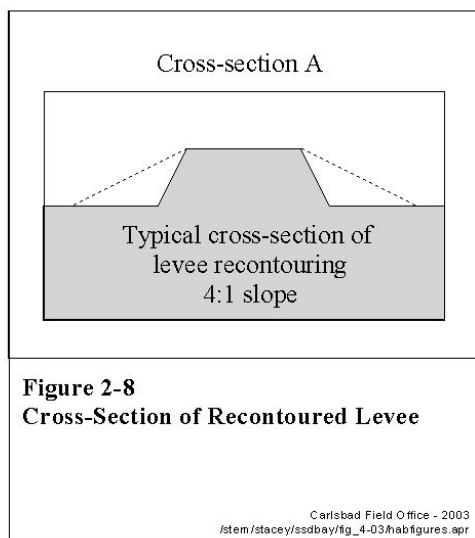
 Bike path



Source: USFWS, Local Agency Partnership 2000 (2 ft imagery).

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amount of fill that would be required is dependent upon the elevation and width of the levee top and the elevation in the pond along the base of the levee. Approximately 24,900 cubic yards of imported material would be required if the internal side slopes of all of the primary and secondary ponds within the system were recontoured to create a 4:1 slope (*Ducks Unlimited 2004*). In addition, substrate enhancement of the recontoured levees would require approximately 11,100 cubic yards of imported sand.



As illustrated in Figure 2-7, additional nesting habitat could be provided by expanding existing levees to create wider linear nesting sites and by creating new “island-like” areas within the ponds. The actual locations for these new nesting areas would be determined during subsequent detailed planning.

Levees selected for widening would be analyzed to determine the most efficient design (i.e., a design requiring the least amount of imported fill material) for achieving the desired configuration. The amount of material required to widen the levee segment between Ponds 13 and 14, as illustrated in Figure 2-7, was determined by

assuming that a segment of widened levee would be approximately 1,200 feet long and 40 feet in width. A 4:1 slope would tie in the fill with the existing pond bottom and a six-inch cap of sand would be deposited on the new levee area. Based on these assumptions, approximately 4,600 cubic yards of base fill material and 1,200 cubic yards of sand would be required to widen this levee. Similar volumes would be required to widen other levees within the system.

Levee Section Between Ponds <sup>1</sup>	Section Length (linear feet)	Required Fill Material (cubic yards)	Surface Area (square yards)	Capping Material (sand) (cubic yards) <sup>2</sup>
10 and 11	3,000	1,200	6,300	1,100
22 and 23	2,000	2,000	7,500	1,200
14 and 15	2,400	1,700	7,800	1,300
13 and 24	4,200	4,600	15,400	2,600
24/25 and 26/27	7,400	15,400	29,000	4,900
<b>Total</b>	<b>19,000</b>	<b>24,900</b>	<b>66,000</b>	<b>11,100</b>

<sup>1</sup>Locations for these levee sections are illustrated in Figure 2-7.

<sup>2</sup>Assumes sand would be placed on the recontoured levees at a depth of six inches.

Source: Ducks Unlimited 2004

A minimum of 22 acres of new nesting area would be created within the primary ponds. Examples of the types of nesting areas envisioned under this proposal are depicted as “filled areas for seabird nesting” on Figure 2-7. The actual volume of fill required to create these areas would be dependent upon the depth of the pond at the fill site and the size of

the area to be filled. For review purposes, the volume of material required to create the areas depicted in Figure 2-7 were calculated. For each new nesting site, it was assumed that the top elevation of the nesting sites would be 8.5 feet NAVD88 and that the side slopes would be constructed at a slope gradient of 4:1. As indicated in Table 2-6, it would be necessary to import approximately 231,600 cubic yards of material to the site to construct the three new nesting areas (*Ducks Unlimited 2004*). This material would include base material required to create the nesting sites and light-colored sand to cap the base. Due to the limited availability of light colored sand in the region, two substrate depths, six inches and three feet, were calculated for each nest area. If an adequate source of light-colored sand is identified, a greater depth of sand would be desirable as it would be expected to deter vegetative growth and allow for some losses of substrate over time due to wind and water erosion.

Table 2-6 Estimated Volume of Fill Required to Create the New Nesting Areas Illustrated in Figure 2-7						
Location of New Nesting Area	Approximate Pond Elevation (NAVD88)	Fill Area (Acres)	6-Inch Substrate Cap		3-Foot Substrate Cap	
			Base Fill Volume (cubic yards)	Substrate Fill Volume (cubic yards)	Base Fill Volume (cubic yards)	Substrate Fill Volume (cubic yards)
Pond 12	1.5	5.5	52,800	4,400	31,900	25,300
Pond 14	1.3	8.9	86,800	7,200	52,200	41,700
Pond 15	1.5	7.9	74,000	6,400	43,800	36,600
<b>Total</b>	- -	22.3	213,600	18,000	127,900	103,600

(Ducks Unlimited 2004)

The sand covered nesting surfaces would ideally be augmented with seashell fragments. In addition, fencing and gates may be installed along some levees to reduce intrusion into nesting areas by humans and animals.

To further enhance nesting opportunities for the western snowy plover, the water levels in one or a portion of one of the secondary ponds would be drawn down annually at the beginning of the nesting season (March) to provide dry nest sites for the plovers. Little or no alteration of the pond levees or elevations within the pond would be required to achieve the desired conditions.

The pelican roosting enhancements described in Alternative A would also be implemented under this alternative.

#### Construction Methods for Proposed Enhancements

With the exception of the proposals to enhance the nesting substrate on the levee tops and regulate water levels in one of the secondary ponds, the enhancement proposals described above would require detailed engineering plans prior to implementation. The following summary of construction methods has been prepared based on experiences from similar types of enhancement proposals.

Earthwork Methods and Equipment: All aspects of levee enhancement would be accomplished using land based equipment, such as dump trucks, excavators, scrapers, and

bulldozers. Specifically, end dump or side dump trucks would be used to transport materials (soil and sand) to the site and then distribute the materials to the appropriate levees. Prior to the transport of this material out onto the levees, some levees may need to be augmented or stabilized to ensure that loaded trucks pass safely through the area without getting stuck, slipping off, or compromising the structural integrity of the levee. This could require the placement of additional material on some levees and/or the use of soil stabilizing fabric and road base. Some levees may be too narrow to accommodate traditional construction equipment, requiring the use of lighter construction equipment.

Once levees identified for stabilization are augmented and deemed suitable, they can be used to transport material to specific enhancement sites. Equipment, such as excavators, compactors, and/or water trucks, would be staged at the deposition site to accept the material and compact it in place. For levee recontouring or the construction of new nesting areas, turn outs or areas with flat slopes would be constructed to permit equipment to be moved aside allowing trucks to pass once their load has been dropped off.

Prior to widening selected levees, the existing elevations within the ponds on either side of the levee to be widened would be verified and the side with the higher invert elevation would be used as the site of the proposed widening. A typical design for widening assumes that a 40-foot wide bench would be constructed at levee shoulder height and would extend for about 40 feet at a 2 percent slope. A 4:1 slope would tie the fill into the bottom of the pond. This bench would be constructed using the same techniques described above for levee recontouring.

Once a levee has been recontoured or widened, or a new nest site has been constructed, the surface would be capped with sand or ideally with a mixture of sand and shell fragments. This material would be trucked to the site and compacted in place. The low cohesiveness of sand makes it readily erodable, so the capped areas would be periodically monitored to assess the actual rate of wind and wave erosion occurring in these areas.

Construction Access Routes/Staging Areas: Construction access onto the site would vary depending upon the timing of project implementation, as well as the timing of any development proposed in the area immediately adjacent to the Refuge. If development on the private property to the east of the Refuge (the area currently occupied by Ponds 50 through 54) has not yet occurred, the Service would attempt to gain a construction access easement from the property owner that would permit access directly from Main Street onto the Refuge. Alternatively, construction access could be taken through the parcel that includes the salt processing plant via an approved construction access easement from the Airport Authority. Under this option, access would most likely be taken via the existing railroad right-of-way that separates Pond 50 through 54 from the rest of the salt works or from a roadway that follows between Ponds 45 and 46 and is extended through Ponds 47 and 48 to access the railroad right-of-way to the south of the salt ponds. Haul routes located on the Refuge would be established using the existing levee system, with much of the activity focused on the outer levees, which have been constructed to accommodate heavier truck traffic.

With the exception of mobilization and demobilization activities, the majority of the truck traffic using Main Street would be trucks hauling fill material and sand to the Refuge for placement in designated enhancement areas. Stockpiled fill soil and sand would most likely be stored within an existing maintenance area located to the southeast of Pond 20.



**Construction Phasing:** Enhancement activities could occur over a one to two-year period and would be scheduled to avoid nesting impacts during the breeding season (late September through February). In some circumstances, construction that does not disturb nesting birds may continue year-round. The extent of work completed each year would vary depending upon the weather conditions in a given year and funding availability.

### **Habitat Protection**

Under this alternative, patrol of the Refuge would be expanded to include periodic patrol of Refuge waters in an effort to minimize the effects of human disturbance on nesting seabirds, migrating shorebirds, and wintering waterfowl. A 5 mph “no wake” speed limit has been established for much of the South Bay. It is currently enforced by the Port’s Harbor Patrol; however, enforcement within the Refuge boundary is limited. No patrol by Refuge staff is currently conducted. As a result, boats and personal watercraft are often observed exceeding the posted speed limit. Excessive speed can flush wintering waterfowl and seabirds that are rafting on the open bay and disturb shorebirds loafing along the shoreline. Under this alternative, Refuge staff, working in cooperation with the Harbor Patrol, would patrol the open waters of the Refuge to enforce the speed limit. This would require the acquisition of a patrol vessel and trailer.

### **Habitat Management**

In addition to the habitat management activities described in Alternative A, this alternative includes a proposal to control accumulated fishing line and other debris within the Refuge by implementing a Monofilament Recovery and Recycling Program (MRRP) modeled after the MRRP developed by the Florida Fish and Wildlife Conservation Commission. The purpose of the program is to educate the public about the problems caused by monofilament fishing line left in the environment, to encourage recycling through a network of line recycling bins and drop-off locations, and to conduct volunteer monofilament line cleanup events. Discarded fishing line represents a serious threat to fish eating birds, shorebirds, and colonial nesting seabirds. Birds can become entangled in discarded fishing line, resulting in serious injury and death. On various occasions, monitors on the Refuge have discovered several dead or dying birds entangled in one length of fishing line within the seabird nesting colonies on the salt pond levees. Other discarded materials, such as various forms of plastic, can also result in injury or death for a variety of bird species, and also pose a threat to the Bay’s population of Federal threatened Eastern Pacific green sea turtles (*Chelonia mydas*).

To reduce this threat to the Refuge’s wildlife, the MRRP would include a public outreach component to encourage anglers to recycle their used fishing line at tackle shops and outdoor bins, while also initiating periodic cleanups along the tidal flats and upper marsh areas of the Refuge. Efforts would also be made to have the MRRP extend beyond the refuge boundary through partnerships with surrounding municipalities, the Port, and appropriate State agencies, such as the California Department of Fish and Game.

### **Public Use Program**

The Refuge’s current public use program, as described for Alternative A, would remain unchanged under this alternative.

### **Other Uses**

**Solar Salt Production:** Commercial solar salt production would continue under this alternative. Some minor changes to the salt ponds would occur as a result of the proposed

nesting enhancements. Additional restrictions or controls beyond those already in place for the existing salt operation could also be implemented, such as the closure of additional access routes during the nesting season, altering current dredging practices, and any other actions as needed to protect the wildlife resources within the salt ponds.

### **Environmental Contaminants**

Under this alternative, funding would be sought to implement the recommendations included in the CAP (refer to Alternative A).

### **Cultural Resource Management**

Under this alternative, the Refuge Manager would seek funds to complete a cultural resource survey for the Refuge. All resources that are identified would be recorded, inventoried, and evaluated for eligibility to the NRHP. As described in Alternative A, a request for cultural resource compliance will be forwarded to the Service's Cultural Resources Team prior to implementing projects that involve ground disturbing activities. When deemed appropriate by the Cultural Resources Team, consultation with the SHPO and interested parties would be conducted.

### **Refuge Facilities**

Under this alternative, additional fences and gates may be installed to protect nesting areas. In addition, temporary construction access roads could be constructed to provide access to the salt pond levees to implement proposed enhancement projects. No permanent Refuge buildings are proposed. As described in Alternative A, agreements to achieve long-term access rights onto the Refuge from the east would be pursued.

### **Step-Down Management Plans**

#### **Fire Management Plan**

The Fire Management Plan described in Alternative A is also proposed under this Alternative (refer to Alternative A for more information).

#### **Predator Management Plan**

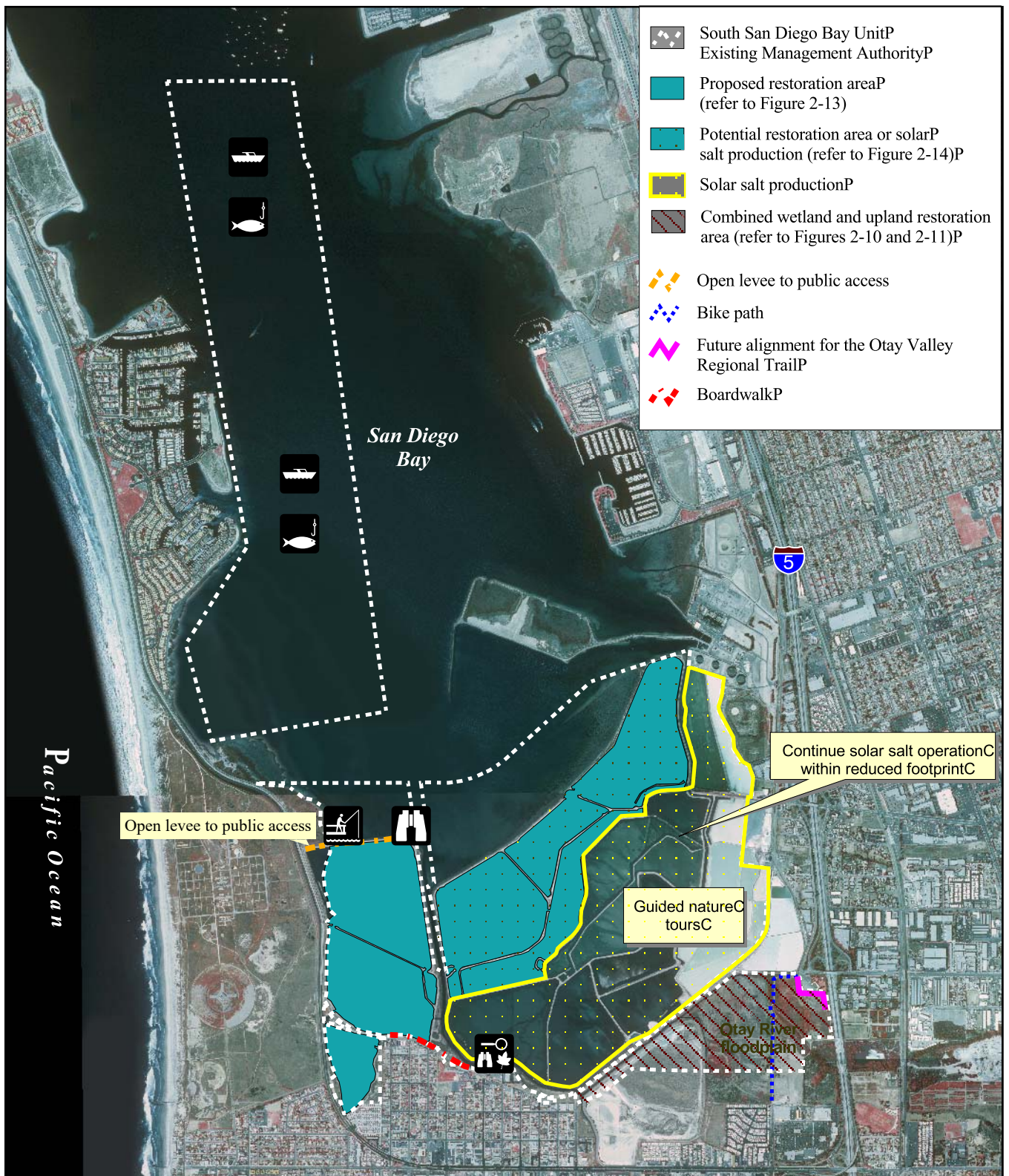
Under this alternative, predator management activities on the South San Diego Bay Unit would be the same as those described under Alternative A of the Sweetwater Marsh Unit and addressed in detail in Appendix M.

### **2.3.2.3 Alternative C – Expand Habitat Management, Enhance Nesting Opportunities, Implement Habitat Restoration, and Expand Existing Public Use Opportunities**

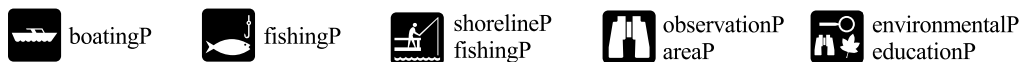
Under Alternative C (Figure 2-9), management activities would be increased to include several habitat restoration proposals, with the intent of expanding those habitats on the Refuge that support listed species. The proposals reflect the need to restore the variety of coastal habitats that have been lost to development in California, and particularly in San Diego Bay, over the past 140 years. Within California, it is estimated that 80 percent of the historic coastal wetlands have been destroyed to accommodate development. Locally, approximately 42 percent of San Diego Bay's shallow water habitat, 84 percent of its intertidal mudflats, and 70 percent of its salt marsh habitat have been filled or dredged to accommodate port uses and associated development (*SDUPD 2000*).

Specific proposals include restoring some salt ponds to tidal influence and excavating portions of the Otay River floodplain to restore intertidal habitat, which historically occurred here. The restoration of intertidal habitat, particularly cordgrass-dominated salt marsh habitat, is intended to benefit the light-footed clapper rail and other avian species, while also expanding the area





**Figure 2-9**  
**South San Diego Bay Unit, Alternative C**



Source: CLocal Agency Partnership (2 ft imagery, year 2000)C

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available to support a variety of fish and benthic invertebrate species. This alternative also proposes to restore native upland and freshwater wetland habitats in the eastern portion of the Otay River floodplain. If implemented, this alternative would result in the restoration of up to 140 acres of intertidal salt marsh, freshwater wetland, and coastal sage scrub habitat within the Otay River floodplain. In addition, up to 410 acres of salt ponds would be restored to intertidal salt marsh habitat.

Opportunities for fishing and wildlife observation would be expanded under this alternative. Solar salt production would continue, but within a reduced footprint.

### **Wildlife and Habitat Management**

This alternative includes the wildlife and habitat management activities described in Alternatives A and B, as well as the additional activities presented below.

### **Habitat Restoration**

This alternative includes two restoration options for both the Otay River floodplain and two restoration options for the salt ponds. These options were developed to allow the Service to fully evaluate the opportunities and constraints of restoring these areas, as well as to present a range of feasible alternatives for evaluation under NEPA. Although the options presented would all achieve the wildlife goals of the Refuge, they each reflect different objectives and strategies for meeting these goals. The specific objectives and strategies associated with these restoration options are presented in Section 2.3.5. Final restoration and engineering plans needed to implement the restoration proposals described under this alternative would be prepared during subsequent step-down planning. It is during this phase of restoration planning that the various studies and additional modeling described below would be conducted.

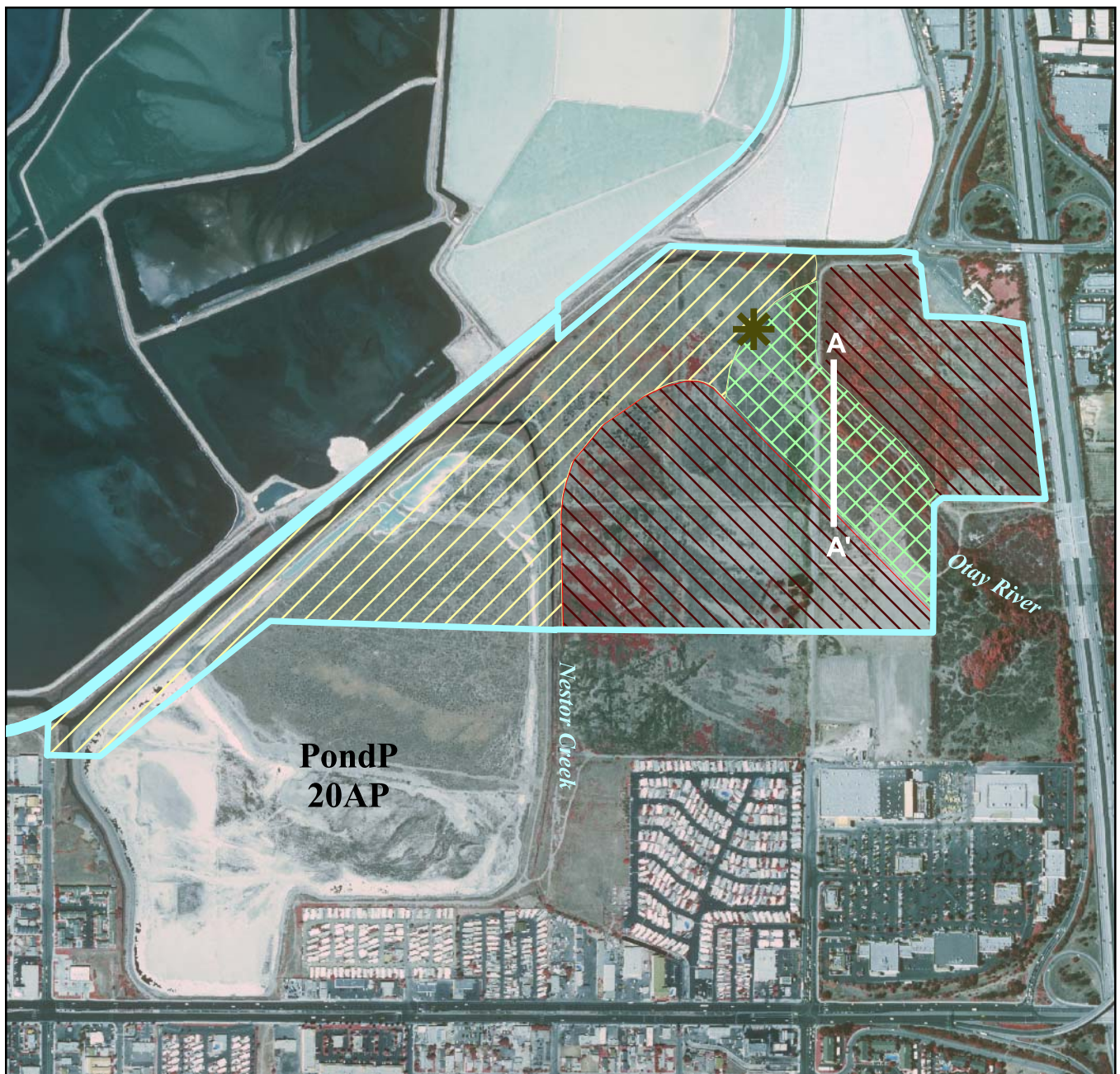
#### **Otay River Floodplain Restoration Option 1 and Restoration Option 2**

The two restoration options developed for the Otay River floodplain are intended to increase the availability of coastal salt marsh habitat for listed species and migratory birds, as well as enhance and restore freshwater wetland and native upland habitat to support the Refuge's native wildlife and plant species. Each of these restoration options would restore approximately 140 acres within the Otay River floodplain to native habitat, but the total acreage of each habitat would be different under each option.






Restoration Option 1 would result in approximately 60 acres of intertidal wetlands, 20 acres of freshwater wetlands, and 60 acres of native uplands, while Restoration Option 2 would provide approximately 90 acres of intertidal wetlands, 15 acres of freshwater wetlands, and 35 acres of native uplands. A more detailed breakdown of the habitats to be restored is provided in Table 2-7.

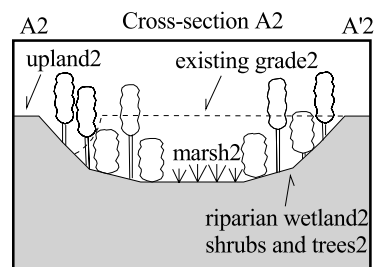
Otay River Floodplain Restoration Option 1 – Expanded River Channel: This restoration option (Figure 2-10) focuses on providing a balance between wetland and upland habitats, with approximately 60 acres to be restored to native upland habitat and about 60 acres to be restored to salt marsh and intertidal mudflats. In addition, the freshwater wetland restoration component of this option would focus on restoring riparian habitat along an expanded Otay River channel. This mix of habitats would support a range of wildlife and plant species, some of which are not currently present on the Refuge, such as least Bell's vireo (*Vireo bellii pusillus*), California gnatcatcher, and salt marsh bird's beak.





**Figure 2-10P**  
**South San Diego Bay Unit, Alternative C - Otay River Floodplain Restoration Option 1P**

-  Refuge management boundary<sup>2</sup>
-  Freshwater wetland<sup>2</sup>  
(30% marsh and 70% riparian)<sup>2</sup>
-  50% intertidal mudflat, <sup>2</sup>  
30% cordgrass, 20% pickleweed<sup>2</sup>
-  Restored uplands<sup>2</sup>
-  Transition from freshwater wetland<sup>2</sup>  
to salt marsh<sup>2</sup>



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Source: USFWS, Local Agency Partnership 2000 (2 ft imagery).

Table 2-7 Habitat Acreages for Alternative C - Otay River Floodplain Restoration Options						
Otay River Floodplain Restoration Options	Habitat Type (Acres)					
	Tidally Influenced Wetlands			Freshwater Wetlands		Restored Upland
	Intertidal Mudflat (50%) <sup>1</sup>	Cordgrass (30%)	Pickleweed (20%)	Marsh	Riparian	
Option 1 – Expanded River Channel	31	19	13	6 (30%) <sup>2</sup>	13 (70%) <sup>2</sup>	61
Option 2 – Expanded Tidal Wetlands	44	26	18	12 (70%) <sup>2</sup>	5 (30%) <sup>2</sup>	38

<sup>1</sup> Percent of total area to be restored to tidally influenced wetlands.

<sup>2</sup> Percent of total area to be restored to freshwater wetland.

Restoration under this option would: 1) restore intertidal mudflat and salt marsh habitat along the northern third of Pond 20A; 2) restore coastal sage scrub and maritime succulent scrub habitats on the remaining upland areas near the eastern boundary of the Refuge; and 3) expand freshwater wetland habitat along the Otay River channel by widening the existing channel along its present alignment.

To restore freshwater wetland habitat, the Otay River channel would be widened to the south of the existing channel by up to 656 feet (200 meters). The new floodway would be contoured to create gentle slopes along the channel edge to support wetland habitat types ranging from freshwater marsh at the lowest elevations to riparian woodland near the top of the slope (refer to Cross-section A in Figure 2-10). Implementation of this restoration option would restore approximately 20 acres of freshwater wetland habitat, with about 30 percent of this acreage supporting freshwater marsh habitat and 70 percent supporting riparian habitat. In the western reach of the river, the habitat would be influenced by tidal action, resulting in a transition from freshwater wetland to salt marsh.

Restoration of salt marsh habitat would involve removing the levee along the northern and northeastern edge of Pond 20A within the Refuge boundary and excavating the land behind the levee to achieve an elevation range of between +0.4 feet NAVD88 at the northern edge of the pond to +5.1 feet NAVD88 at the southern Refuge boundary. The intent is to create approximately 60 acres of marsh plain by grading the area to elevations known to support a range of intertidal habitat types. The proposed mix of habitats would consist of 50 percent intertidal mudflat, 30 percent cordgrass-dominated salt marsh, and 20 percent pickleweed-dominated salt marsh. Under this option, a new levee could be constructed within Pond 20A along the southern Refuge boundary or the area could be graded to meet the existing grade at the property line (daylight graded). The latter would require coordination with and approval by the Port, which owns the southern portion of Pond 20A.

To achieve the desired wetland habitats, approximately 725,000 cubic yards of material would be excavated from the site. Depending upon the soil characteristics, grain size, and other factors, this material could be exported from the site; placed on those areas of the

site proposed for upland restoration; used to construct the levee that would be relocated to the southern Refuge boundary in Pond 20A; and/or used to restore and enhance habitat within the salt ponds, as will be described later in this section. The construction activities required to implement restoration within the Otay River floodplain are described later in this chapter under the section “Construction Methods for Restoring the Otay River Floodplain.”

The proposed restoration of native upland habitat would occur in two locations: a 22-acre site located to the east of the Otay River channel and a 39-acre site located to the east of Nestor Creek and to the west of the Otay River channel. Prior to restoration, these upland areas could be used as disposal sites for material generated during excavation of the proposed wetland areas. Preliminary estimates indicate that all of material generated during excavation to accommodate the restoration of intertidal wetland habitat (approximately 723,000 cubic yards of material) could be disposed of on these sites. This would raise the elevation of the sites by approximately eight feet. Slopes around the perimeter of these sites would not exceed a gradient of 4:1 and would be contoured to produce a more natural appearance. Assuming these two upland areas are used as disposal sites, the material placed on these sites would be compacted as appropriate for restoration and then revegetated using a combination of native seed mixes and container stock. The specific plant palettes, temporary irrigation plans, and maintenance and monitoring criteria for these restoration sites would be developed in association with the completion of final engineering planning for the overall project.

Otay River Floodplain Restoration Option C2 – Expanded Tidal Wetlands: Although similar in some respects to Option 1, Restoration Option 2 (Figure 2-11) focuses on maximizing salt marsh restoration in support of the light-footed clapper rail and other avian species that are dependent upon intertidal habitat for survival. In addition to salt marsh habitat, this restoration option would also result in the restoration of freshwater wetland and native upland habitat.

To restore salt marsh habitat, the levees within the Refuge boundary that occur to the south of the Otay River, as well as along a portion of Nestor Creek would be removed. Extensive portions of the floodplain would be excavated to create a sloping marsh plain, with elevations along the southern edge of the Otay River channel at about +0.4 feet NAVD88 gently rising to about +5.1 feet NAVD88 at the southern Refuge boundary.






Implementation of this restoration option would restore approximately 90 acres of marsh plain, consisting of approximately 50 percent intertidal mudflat, 30 percent cordgrass-dominated salt marsh, and 20 percent pickleweed-dominated salt marsh habitat. As in Option 1, the existing levee along the top of Pond 20A could be relocated to the southern Refuge boundary or if the levee is not related, the grading necessary to create intertidal habitat would daylight at the property line. Grading along the southern property line to the east of Nestor Creek would involve excavating a 4:1 slope from the existing grade down to high salt marsh (an elevation of approximately +6.4 feet NAVD88).

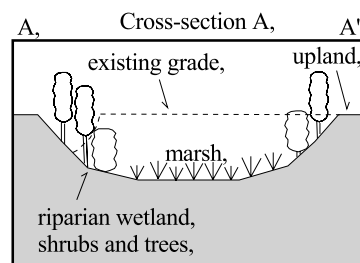
The site’s current freshwater wetland habitat would be expanded by excavating a 15-acre upland area to the east of the existing bike path (refer to Figure 2-11). A pilot channel would be constructed due west from the point where the river channel currently enters the Refuge along the eastern boundary to a point where the pilot channel would empty into the graded marsh plain. This pilot channel is intended to direct larger storm flows from the Otay River through the center of the property, rather than through the existing undersized





**Figure 2-110**  
**South San Diego Bay Unit, Alternative C - Otay River Floodplain Restoration Option 20**

-  Refuge management boundary,
-  Freshwater wetland,  
(70% marsh and 30% riparian),
-  50% intertidal mudflat, ,  
30% cordgrass, 20% pickleweed,
-  Restored uplands,
-  Transition from freshwater wetland,  
to salt marsh,



0.25p 0p 0.25p Miles

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Source: pUSFWS, Local Agency Partnership 2000 (2 ft imagery)p

channel that extends north and then west along the edge of the salt works. This new pilot channel would support freshwater habitat east of the Saturn Boulevard bike path, but would transition to salt marsh habitat west of the bike path where the area would be excavated to an elevation of approximately +3.4 feet NAVD88. The area proposed for freshwater wetland would be designed to maximize freshwater marsh habitat. Approximately 70 percent of the area to be restored to freshwater wetland would be restored to freshwater marsh habitat and 30 percent to willow scrub habitat (refer to Cross-section A in Figure 2-11).

To achieve the desired wetland habitats, preliminary estimates indicate that approximately 970,000 cubic yards of material would be excavated from the site. All or a portion of this material could be exported from the site; placed on those areas of the site proposed for upland restoration; used to construct a new levee along the Refuge's southern boundary within Pond 20A; and/or used to restore and enhance habitat on within the salt ponds.

A smaller area of upland habitat would be restored under this option, with 22 acres proposed for upland restoration to the east of the Otay River channel and 16 acres proposed for an area located immediately to the west and south of the existing channel. An appropriate mix of habitats, including upland transition, coastal sage scrub, and maritime succulent scrub, would be restored in this area, with the specific plant palette, temporary irrigation plans, and maintenance and monitoring criteria to be developed in association with the completion of final restoration plans for the overall restoration proposal.

As described for Option 1, these upland areas may be used as a disposal site for material generated from the excavation of adjacent wetlands prior to restoring native upland habitat. If all of the excavated material (970,000 cubic yards) were to be placed on the proposed upland areas, the surface elevation of the sites would be raised by approximately 18 feet. To avoid any significant adverse effects related to visual quality, these sites would be raised no more than 8 feet in elevation (which would result in the disposal of approximately 460,600 cubic yards of material under Option 2). All remaining material would be used to reconstruct levees along Pond 20A and Nestor Creek, to enhance nesting areas, to raise pond elevations to accommodate appropriate habitat types, and/or be removed from the site to an approved disposal area. The actual method of disposal would be determined during the completion of final engineering and design and would take into consideration the soil characteristics of the excavated material, the restoration option ultimately chosen for implementation, and a review of pertinent environmental constraints. The construction methods to be implemented during restoration are described below.

#### Construction Methods for Restoring the Otay River Floodplain

Implementation of either restoration options presented for the Otay River floodplain would require the development of detailed engineering plans and a full description of construction and revegetation methods. Once these details are available, additional analysis under NEPA may be required to address potential environmental consequences not anticipated in this document. The following summary of construction methods has been prepared using information obtained from similar types of restoration proposals.

**Earthwork Methods and Equipment:** Construction would begin following the completion of any required remediation of contaminated soils on the site (refer to Section 3.3.8). Once contaminants issues have been appropriately addressed, the construction access routes would be graded and the construction staging area prepared. One or more temporary



access bridges would be installed to provide access from the restoration site to Main Street via the southern levee access road on the salt works. The area to be excavated and restored to wetlands would then be cleared of existing vegetation. If the project is to be implemented in phases, clearing would also be implemented in phases to reduce the potential for erosion and downstream sedimentation.

Earthwork equipment for this project can be classified into two main categories: land-based equipment, such as excavators, dump trucks, scrapers, and bulldozers, and floating equipment, such as dredges. Both land-based and floating equipment have specific inherent advantages and disadvantages. The method selected would depend upon site specific conditions, such as the ability to de-water; whether material is being imported to the site or relocated within the site; where borrowed material is removed; and where the borrowed material is to be deposited. Similarly, for each category the type of equipment used depends upon the same factors (such as using a scraper versus using the combination of an excavator and dump truck).

Land-based equipment is primarily used to relocate large quantities of material within a site or to haul material to an offsite upland location. Borrow and fill areas must be dry enough to permit a scraper to operate without getting stuck. If fill areas are too wet, it may be necessary to deposit excavated material on an area nearby where it can be stockpiled and then moved to the fill site using more appropriate equipment. The main advantage of scrapers is that they are self-loading. This allows multiple pieces of equipment to be in production without waiting for their turn to be loaded. Draglines and excavators are best suited for excavating trenches or pulling material out of wet areas where scrapers cannot operate. Excavators are always preferred over draglines. The latter is only used if the required reach is in excess of 50 feet. Excavators can be placed on mats that decrease the pressure they exert on the soil enabling them to access sites such as a wet marsh. Low ground pressure dump trucks are also available that can be used in wetter areas. Normally, excavators are used in conjunction with trucks for transportation of the material, although if the material is allowed to dry, scrapers could be used as well. Excavators can also be placed on barges and used as a dredge (*Ducks Unlimited 2004*).

Land-based equipment comes in a large range of sizes. The larger equipment obviously has the ability to move more earth in a given time period, but also requires more effort to mobilize. In addition, the size of equipment that can be utilized is governed by the ability of the site conditions to support it. Land-based equipment normally includes a motor grader to cut and maintain haul roads, along with a water truck to control dust.

Floating equipment includes hydraulic dredges and mechanical dredges, such as clamshells. The latter are normally used to excavate underwater trenches or to remove material in areas where other equipment is unable to operate. The excavated material must be mechanically handled to move it off of the dredge and to its final destination. This multiple handling of material increases costs and reduces the removal efficiency. Hydraulic dredges are designed for moving vast amounts of material over relatively large distances. If the conditions warrant their use, the hydraulic dredge is by far the most efficient method of relocating material. This is primarily due to the sheer volume of material moved. Further, because the material is pumped, it does not have to be handled more than once to get it to its final destination. If dredge spoils are intended for use as structural fill, they must be allowed to dry for some time before they are re-worked and compacted into place (*Ducks Unlimited 2004*).

Hydraulic dredges are also available in a variety of sizes. The advantage of smaller dredges is that they can operate in shallower water depths. The disadvantage is that they move less material in a given time and over shorter distances. Booster pumps can be placed in the discharge lines of smaller dredges to increase the distances the slurry is pumped. Conversely, if an area can be located or excavated where a larger dredge can get started, it can work its way through a shallow pond by cutting its own channel. Dredges must have an ample supply of water to operate effectively.

Dredges operate by cutting into the mud and mixing it with ambient water to create a slurry consisting of roughly 10 to 20 percent solids. The advantage that this has over other methods of dredging is that once the mud is slurred it usually is self-leveling and will run flat when discharged. The discharge can be placed on uplands with a water return plan or discharged into another water body. Dredging operations often run 24-hours a day to eliminate the lengthy start-up and shutdown procedures.

Excavation in the Otay River floodplain would most likely be accomplished using land-based equipment. The equipment would mobilize into the farthest reaches of the work area and retreat as the material is removed. Using backhoes, scrapers, and other land-based equipment, the construction site would then be excavated down to elevations appropriate for supporting the desired habitat types shown on the restoration plans.

It would be possible to excavate the material for the proposed intertidal areas using a hydraulic dredge, but this would only be practical if a temporary weir could be constructed across the river channel that would maintain a specified minimum water level within the work area. The advantage of the weir would be that any sediment plume created by the work would be maintained within the site. In addition, the excavated material could be pumped directly to its destination site, be it uplands within the floodplain or fill areas within the salt works. This would reduce the duration of construction by eliminating double handling of the material. Water could, however, be a limiting factor. The advantages and disadvantages of using a hydraulic dredge to implement restoration in the Otay River floodplain will be evaluated further when detailed restoration plans are prepared for this area.

Construction Access Routes/Staging Areas: Daily construction traffic would enter and exit the site via Main Street in Chula Vista. This would require the placement of a temporary bridge across the drainage channel that extends west from the freeway along the south side of Main Street and/or across the Otay River channel at a point west of the existing bike path. Construction traffic would only be permitted to enter the site from Saturn Boulevard during project mobilization and demobilization, which would involve only a few days at the beginning and end of the project or project phases. Primary construction access routes and proposed staging areas for the various restoration proposals would be contained within the Refuge Unit. A system of circular haul roads would be created to ensure the most efficient method of transporting material within the site and possibly to the salt works. Adequate room would be provided at the excavation and fill sites for efficient operation of equipment, such as compactors, excavators and water trucks.

The primary construction staging area would be located on the disturbed uplands west of the extension of Saturn Boulevard on Refuge property. Temporary fencing would be placed around the perimeter of the staging area to address security and safety issues.

Disposal Methods: As described previously, excavated material could be disposed using several methods, depending upon the soil characteristics, grain size, and other factors. The most likely method would be on-site disposal involving placement of material on areas proposed for upland restoration, use of some of the material to construct a new levee along the southern Refuge boundary in Pond 20A, and/or used to restore and enhance habitat within the salt works, as will be described later in this section.

Other disposal options that are not currently being considered include deep water ocean disposal and off-site disposal via truck or rail to approved development projects or landfills in the region.

Construction Phasing: The time required to complete the proposed restoration projects could be affected by a number of variables, including site conditions; type, size and numbers of equipment used; hours of operation; weather; the availability of materials or opportunities for disposal; and/or seasonal work stoppages related to the avoidance of impacts during the nesting season. Moderately-sized land-based equipment would be used to excavate the Otay River floodplain under Options 1 and 2. Two time estimates were developed for each option. One estimate assumed the use of only excavators, with five excavators each moving 500 to 1,000 cubic yards per day. The other estimate assumed that a combination of five excavators and 12 scrapers would be used, with the scrapers operating during the initial phases of the project to remove the upper layer of soil.

Based on the assumption described above and assuming construction would proceed with no stoppages, it would take approximately five to 10 months to complete the grading required for Restoration Option 1 using only excavators. If a combination of scrapers and excavators are used, the project would likely take from three to seven months to complete. Using these same assumptions, it would take approximately seven to 10 months to complete the grading required for Restoration Option 2 using only excavators and five to 10 months using a combination of scrapers and excavators. Additional time would be required for planting; installation of erosion control measures, fencing, signage and/or temporary irrigation lines; and any other activities associated with restoration. It is likely that construction would begin with tidal restoration of the western portion of the planning unit, followed by restoration of the eastern end of the floodplain.

Temporary Closure and/or Rerouting of the Saturn Boulevard Bike Path: The grading activity proposed in the Otay River floodplain to implement restoration would require the temporary closure and/or realignment of the existing bike path that extends north/south from Main Street south to the paved section of Saturn Boulevard to the south of the Refuge. Any temporary or permanent changes to the bike path alignment would require coordination with and approval by the City of San Diego.

#### Salt Works Restoration Option 1 and Option 2

Two restoration options have also been developed and evaluated for the salt ponds, with each proposing to restore tidal influence to some portion of the existing pond system. The proposed restoration is intended to provide additional habitat for an array of migratory birds, particularly the endangered, threatened, and special status species that utilize the salt ponds seasonally or on a year round basis. Under Salt Works Restoration Option 1, approximately 200 acres of intertidal wetlands would be restored, while approximately 440 acres of intertidal wetlands would be restored under Option 2. A more detailed breakdown of the habitat types that could be restored under each option is presented in Table 2-8.

The actual mix of habitat types, including tidal channels, unvegetated mudflats, and

cordgrass and pickleweed-dominated salt marsh, would be determined during subsequent detailed restoration planning. The implementation of either of these options would require some reconfiguration of the remaining ponds to facilitate a reduced commercial solar salt operation.

<p><b>Table 2-8</b>  <b>Habitat Acreages for</b>  <b>Alternative C - Salt Works Restoration Options</b></p>								
Alt. C – Salt Works Restoration Options	Habitat Type (Acres) <sup>1</sup>							
	Shallow Subtidal Habitat	Intertidal Mudflat	Salt Marsh (Cordgrass dominated)	Salt Marsh (Pickleweed dominated)	Levees Around Restored Ponds	Potential Nesting Area		Active Salt Ponds <sup>3</sup>
						New	Enhanced Levees <sup>2</sup>	
Option 1 - Restored Western Ponds	13	11	163	10	<u>30</u>	18	variable	815
Option 2 - Restored Primary Ponds	32	95	297	16	<u>75</u>	18	variable	519

<sup>1</sup> These acreage figures are subject to change during detailed restoration planning and are provided here to facilitate the analysis of potential impacts as a result of manipulating existing pond elevations and restoring tidal influence to various salt ponds.

<sup>2</sup> The actual acreage of enhanced levees would be determined during final restoration planning

<sup>3</sup> These acreage figures include the levees and open water areas of the active salt ponds.





Prior to final restoration planning, substrate analyses of pond sediments and the material to be excavated from the Otay River floodplain would be completed to determine the suitability of the sediments for salt marsh restoration. This analysis would consider factors such as grain size, salinity levels, organic content, and availability of nutrients. An investigation would also be conducted to characterize the extent and type of contamination, if any, within the areas to be excavated. If remediation is required, it would be conducted prior to or in association with restoration.

The restoration options proposed for the salt works would be compatible with either of the two restoration options described above for the Otay River floodplain. A complete description of each of the salt works restoration options is presented below.

Salt Works Restoration Option 1 – Restored Western Ponds: This restoration option emphasizes the restoration of cordgrass-dominated salt marsh (Figure 2-12) to support the endangered light-footed clapper rail. Tidal channels and associated tidal flats would be incorporated into these salt marsh areas to provide a variety of microhabitats and foraging areas to support an array of wetland species. Existing nesting habitat for seabirds would continue to be protected and enhanced, as described in Alternative B, and habitat for brine invertebrates would continue to be provided within a reduced solar salt production area. Any pelican roosting platforms located in ponds to be restored would be moved to other ponds within the system.



**Figure 2-12**  
**South San Diego Bay Unit, Alternative C**  
**Salt Works Restoration Option 1**

-  Levee breach or water control structure (subject to relocation)
-  Filled area for seabird nesting
-  Enlarged levee for seabird nesting at selected locations
-  Roadbed and levee recontouring with substrate enhancement

-  Proposed salt production
-  Intertidal mudflat
-  Cordgrass
-  Salt marsh

**Note:**

1. Ponds would be graded to optimize cordgrass habitat for the Least-footed Gull and Ring-billed Gull.
2. Pond elevations could be altered to achieve desired habitat types.
3. Specific locations and sizes of proposed seabird nesting improvements to be determined.
4. A reduction in the existing salt operation would occur.
5. Restoration of the northwest corner of Pond 11, which is owned by the U.S. Navy, would require removal from the Navy prior to implementation.



Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)

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Under this restoration option, the ponds located to the west of the Otay River channel (Ponds 10, 10A, and 11) would be breached, restoring tidal influence to approximately 200 acres of salt ponds. (Coordination with the Navy would be required during detailed restoration planning to address potential changes to the northwestern corner of Pond 11, which is owned by the Navy.) The portions of the levees not affected by breaching would be maintained to provide roosting and nesting habitat for various avian species.

Prior to breaching, the western ponds would be drained by closing the tide gate and allowing much of the water within the ponds to flow further into the salt production system. This would further concentrate the salt contained in the water column and allow it to be harvested from the system in the crystallizer ponds. Once the majority of the water has been removed from the ponds, they would be graded and recontoured to achieve the desired intertidal habitats, including cordgrass-dominated salt marsh habitat. To achieve the desired elevations, which for cordgrass habitat is between +2.86 feet NAVD88 and +3.86 feet NAVD88, appropriate fill material would be placed in Pond 11 to raise the existing elevation. Material would have to be removed from Ponds 10 and 10A to lower the existing elevation. Excess material from Ponds 10 and 10A would be moved to Pond 11. Under the preliminary design illustrated in Figure 2-12, approximately 165,200 cubic yards of additional material would have to be imported into Pond 11 to achieve an average elevation of +3.4 feet NAVD88. The estimated cut and fill volumes required to achieve the desired pond elevations in Ponds 10, 10A, and 11 are presented in Table 2-9. The earthwork calculations assumed elevations that represent the outer limits of the habitat range for each habitat type considered. Therefore, to achieve a better grading balance throughout the restored ponds, the final engineering plans may include additional cut or additional fill in certain ponds and still maintain the desired habitat goals. For example, by excavating the ponds to the lower end of the habitat ranges, more cut material would be generated for use elsewhere in the system, thus reducing the quantity of fill material required to achieve the desired restoration goals.

<b>Table 2-9</b> <b>Estimated<sup>1</sup> Cut and Fill Volumes<sup>2</sup></b> <b>for Obtaining the Elevations Proposed Under Salt Works Restoration Option 1</b>										
Pond #	2.9 feet NAVD88 (intertidal mudflats)			3.4 feet NAVD88 (cordgrass-dominated salt marsh)			3.9 feet NAVD88 (pickleweed-dominated salt marsh)			Pond Net
	Cut	Fill	Net	Cut	Fill	Net	Cut	Fill	Net	
10	(2,600)	100	(2,500)	(77,300)	700	(76,600)	(6,400)	300	(6,100)	(85,200)
10A	-	-	-	(20,800)	0	(20,800)	-	-	-	(20,800)
11	-	-	-	(1,200)	272,500	271,300	(100)	-	(100)	271,200
Total	(2,600)	100	(2,500)	(99,300)	273,200	173,900	(6,500)	300	(6,200)	165,200

<sup>1</sup> Volumes are based on preliminary restoration plans and should not be viewed as specific values.

<sup>2</sup>All volumes are presented in cubic yards.

Once the desired elevations have been achieved, the pond levees would be breached to introduce tidal action into the ponds. The size of the breach would range from 15 to 30 feet in length. All of the affected ponds could be breached in one season, or breaching could be phased over several years.

Salt Works Restoration Option 2 – Restored Primary Ponds: Under this restoration option (Figure 2-13) all of the primary ponds within the system (Ponds 10A and 10 through 15)





**Figure 2-13**  
**South San Diego Bay Unit, Alternative C**  
**Salt Works Restoration Option 2**



**Note:**

1. Ponds would be graded to optimize cordgrass habitat for the light-footed Clapper Rail.
2. Pond elevations could be altered to achieve desired habitat types.
3. Existing nesting bird areas are protected and some enhancements are proposed.
4. Specific locations and sizes of proposed seabird nesting improvements to be determined.
5. A reduction in the existing salt operation would occur.
6. Reconfiguration of salt ponds may be necessary to accommodate a reduced operation.
7. Restoration of the northwest corner of Pond 11, which is owned by the U.S. Navy, would require approval from the Navy prior to implementation.



0.25 0 0.25 Miles

Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)

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would be restored to tidal influence to facilitate the restoration of approximately 440 acres of intertidal wetlands. Tidal influence would be restored by breaching the outer levees of the ponds. The remaining levees around these ponds would be maintained to provide roosting and nesting habitat for shorebirds, seabirds, and other waterbirds.

Existing nesting habitat for seabirds would continue to be protected and enhanced, as described in Alternative B. Brine invertebrates would continue to be present, but in a significantly reduced solar salt production area. The number of pelican roosting platforms provided within the salt ponds may be limited under this option. Alternative A envisioned three platforms within the ponds if monitoring indicated a favorable response to the platforms by the pelicans. Restoration of the primary ponds would reduce the area available for platform installation. If adequate area is not available within the ponds, one or more of the platforms could be installed in the open bay portion of Refuge. Additional monitoring would be required for any platforms installed in the bay to determine the extent, if any, of human disturbance on roosting pelicans.

Option 1 focused on increasing cordgrass-dominated salt marsh habitat to support the light-footed clapper rail, while this restoration option would provide additional types of wetland habitat including shallow subtidal, intertidal mudflat, cordgrass-dominated salt marsh, and pickleweed-dominated salt marsh. As in Option 1, an effort would be made to move the existing water in the ponds further into the salt evaporation system prior to breaching to allow harvesting of the salts in the water column. Once the ponds are drained, the outer levees would be breached to create an opening 15 to 30 feet wide. If the ponds cannot be drained prior to breaching, the water within the ponds would be flushed into the bay by tidal action.

Pond breaching would be scheduled to occur between the months of October and February to avoid the breeding season. Breaching could occur as a single project, or could be phased over several months or years. The grading described in Salt Works Restoration Option 1 for the western ponds (Ponds 10A, 10, and 11) would also be implemented under this option. In addition, portions of Ponds 12 and 13 would be filled to raise the bottom of the ponds to an elevation suitable for establishing cordgrass, while the elevations in portions of Ponds 14 and 15 would be raised to support intertidal mudflat habitat. An estimated 468,100 cubic yards of appropriate fill material would be needed (*Ducks Unlimited 2004*) to achieve optimum elevations within the primary ponds under this option. The estimated cut and fill volumes required to achieve the desired pond elevations in Ponds 10A and 10 through 15 are presented Table 2-10. As described under Salt Works Restoration Option 1, the actual elevations in each pond would be refined during the preparation of final grading plans to better balance the amount of cut and fill within the restoration area.

Once the levees are breached, natural recruitment of plant, animals, and other organisms would occur over time as the tides facilitate nutrient exchange and disseminate flora and fauna into the breached ponds.

<b>Table 2-10</b> <b>Estimated<sup>1</sup> Cut and Fill Volumes<sup>2</sup></b> <b>for Obtaining the Elevations Proposed Under Salt Works Restoration Option 2</b>										
Pond #	2.9 feet NAVD8 (intertidal mudflats)			3.4 feet NAVD88 (cordgrass-dominated salt marsh)			3.9 feet NAVD88 (pickleweed-dominated salt marsh)			Pond Net
	Cut	Fill	Net	Cut	Fill	Net	Cut	Fill	Net	
10	(2,600)	100	(2,500)	(77,300)	700	(76,600)	(6,400)	300	(6,100)	(85,200)
10A	-	-	-	(20,800)	-	(20,800)	-	-	-	(20,800)
11	-	-	-	(1,200)	272,500	271,300	(100)	-	(100)	271,200
12	-	-	-	(2,300)	193,900	191,600	(700)	100	(600)	191,000
13	-	-	-	(10,400)	88,400	78,000	-	-	-	78,000
14	(1,800)	6,000	4,200	-	-	-	-	-	-	4,200
15	(1,400)	28,500	27,100	-	200	200	-	2,400	2,400	29,700
Total	(5,800)	34,600	28,800	(112,000)	555,700	443,700	(7,200)	2,800	(4,400)	468,100

<sup>1</sup> Volumes are based on preliminary restoration plans and should not be viewed as specific values.

<sup>2</sup> All volumes are presented in cubic yards.

#### Salt Works Restoration – Construction Methods

Implementation of either of these two restoration options would require the development of detailed restoration and engineering plans and a full description of construction methods. Once these details are available, additional analysis under NEPA would be conducted. Provided below is a summary of the anticipated construction methods. This information may be refined following the completion of detailed construction plans for this area.

**Earthwork Methods and Equipment:** It is likely that a hydraulic dredge would be used to implement restoration within the salt works, as it is doubtful that the bottoms of the ponds could be recontoured using land-based equipment. Given the magnitude of grading proposed in the various ponds, a 10-inch portable hydraulic dredge would likely be the most appropriate type of equipment to be used to achieve the desired elevations, provided water levels could be maintained during the operation. A portable dredge would be trucked to the project site in modules and assembled onsite to minimize mobilization costs. Assembly of the dredge could occur on the project site or at a nearby harbor where the dredge would then be towed to the salt works.

The use of a hydraulic dredge would greatly reduce the time required to complete the proposed work, and would also reduce the stress on the levees that would otherwise need to be used as haul roads. The primary disadvantage of using hydraulic dredging is that the fill added to the ponds would not be compacted, making it more susceptible to erosion than fills placed using land-based equipment. In addition, the final grade of placed fill would not be as controllable with hydraulic equipment as it would be with land based equipment. Either the elevation and slope tolerances would have to be loosened or the area reworked after the fill has had time to settle and dry out, which could take upwards of a year.

Dredges need a significant water depth in order to operate efficiently, therefore, recontouring would have to be accomplished prior to removing a significant volume of water from the ponds, or the ponds would have to be refilled with bay water prior to dredging. Either way, the ponds would be recontoured prior to breaching. This would allow any sediment plume to be trapped within the pond system. Once the desired

elevations in the ponds are achieved, the pond levees would be breached using an excavator. Material removed from the levee to create a 15- to 30-foot breach would be side cast to the adjacent interior levee slope.

Levee Protection: Within the salt ponds the southern levees currently form the northern edge of the Otay River channel. These levees are subject to overtopping during a significant flood event. Such an event could result in significant damage to the restored intertidal habitat in Ponds 12, 13, 14, and 15. Various slope protection measures can be incorporated into the restoration design to reduce the potential for levee failure during overtopping. Such measures include the use of biotechnical bank stabilization (the use of living plant material to reinforce soil and stabilize slopes), stone revetment, geotextile-reinforced soil, and concrete armor unit revetment. To provide a conservative assessment of the potential impacts that could result from the installation of levee protection measures, the project description assumes that the entire length of the levee along Ponds 20, 22, and 48 would be protected with a stone revetment from the top of the levee to an appropriate depth below the channel bottom. This revetment would be covered with geotextile-reinforced soil and revegetated with native plants to soften the appearance of this feature.

Following restoration, the levees within the salt works would be retained in their concurrent configuration. The only changes proposed to the levees include the reinforcement described above, the enhancements proposed to improve the habitat quality for nesting seabirds, and the occasional breaches in the levees to facilitate tidal circulation. Some of these breaches may be bridged to maintain access around to outer levees for maintenance, monitoring, law enforcement, and specific public uses. Because of the potential for erosion, particularly to the outer levees, from wind, wind-generated waves, and tidal currents moving in and out of the ponds, the levees would require routine monitoring and occasional maintenance to ensure the long-term stability of the levees.

Construction Access Routes/Staging Areas: As described previously, daily construction traffic would enter and exit the site via Main Street. From that point, all construction traffic would utilize specified levee roads. If fill material were to be imported from the Otay River floodplain, then a temporary bridge could be placed across the drainage channel that extends west from the freeway along the south side of Main Street and/or across the Otay River channel at a point west of the existing bike path.

The primary construction staging area would be located at an existing fenced construction area located between Ponds 20 and 22. The site is already graded and fenced, and is used by the current operator of the salt works.

Construction Phasing: The time required to complete the proposed excavation within the ponds is dependent upon the same factors described for the Otay River floodplain restoration options. Estimates of the time required to excavate the various ponds under Options 1 and 2 assumed the use of a 10-inch hydraulic dredge. Completion of all of the actions proposed for Salt Works Restoration Option 1 is expected to take approximately one to two years, assuming construction would proceed with no stopages. The completion of required dredging for Salt Works Restoration Option 2 is expected to take 1.5 to three years. The time required for project completion could be greatly reduced if it is determined that a larger dredge can be used. If the restoration is phased, it is likely that construction activity would begin in Pond 11.

### Range of Restoration Scenarios Possible Under this Alternative

Several combinations of restoration scenarios could be implemented under Alternative C as presented in Table 2-11. Some scenarios would result in the need to export or import material to achieve the restoration objectives. Others would result in a balanced grading scheme in which the cut and fill volumes required by each restoration option could be obtained or disposed of on site, eliminating the need to import or export material. The only exception would be the need to import clean sand, which would be required under any of the scenarios presented.

### **Public Use Program**

Under this alternative, existing public uses would be expanded.

### **Public Access**

Public access onto this Refuge Unit would continue to be permitted within the open waters of the bay. The number of guided nature tours conducted around the salt ponds would increase. This alternative also proposes to open the northern levee of Pond 11 to public access during daylight hours for the purpose of accommodating wildlife observation and fishing. Also proposed is the construction of a 0.4-mile pedestrian path along the southern edge of the Refuge from 7<sup>th</sup> Street to about 10<sup>th</sup> Street in Imperial Beach. This pedestrian path, which is described in greater detail below, would accommodate wildlife observation activities in the vicinity of the restored western ponds. The pedestrian pathway could also be incorporated into habitat restoration plans for the area to the north of the Bayshore Bikeway between Florida Street and 13<sup>th</sup> Street.

### **Wildlife-Dependent Recreational Uses**

Fishing: The fishing opportunities currently available on the Refuge would be expanded to include shoreline fishing from the northern levee of Pond 11 (refer to Figure 2-9). Fishing along this levee would occur at specified areas and would be permitted only on the bay side of the levee. This activity would be subject to the fishing regulations established by the California Department of Fish and Game. Improvements to the levee would be required to adequately accommodate a shoreline fishing program. These improvements, which would be developed as part of a step-down public use plan for this area, could include hardening of the levee surface to ensure appropriate accessibility; establishing fishing platforms along the levee to reduce the potential for erosion along the outer levee slope, constructing an informational kiosk; installing fencing and gates to control access and avoid unauthorized access beyond the northeastern end of the levee; and developing other facilities that may be deemed appropriate to accommodate this use.

Wildlife Observation and Photography: Opportunities for wildlife observation and photography are currently provided in Refuge waters via watercraft, during guided nature tours around the salt ponds, and immediately adjacent to the Refuge along the Bayshore Bikeway and from the County's Biological Study Area. These opportunities would be expanded under Alternative C to include an increase in the number of guided nature tours and construction of an observation area at the eastern end of Pond 11's northern levee.

The number of guided nature tours would be increased to approximately two tours per month between mid-September and early February of each year. No tours would be provided during the nesting season to avoid disturbance to nesting birds. Guided tours could be lead by Refuge staff or authorized volunteer organizations, such as the Chula Vista Nature Center and the San Diego Audubon Society. These tours would provide the



**Table 2-11**  
**Various Restoration Scenarios<sup>1</sup> Under Alternative C**  
**with Estimated Net Grading Requirements for Each Scenario**

Estimated Net Grading Volumes (cubic yards)	Otay Option 1	Otay Option 1 + Salt Works Option 1	Otay Option 1 + Salt Works Option 2	Otay Option 2	Otay Option 2 + Salt Works Option 1	Otay Option 2 + Salt Works Option 2	Salt Works Option 1	Salt Works Option 2
Otay Floodplain – Cut	723,000	723,000	723,000	970,000	970,000	970,000	0	0
Otay Floodplain – Fill	565,600	400,400	97,500	460,600	460,600	344,500	0	0
Salt Works – Cut	0	0	0	0	0	0	0	0
Salt Works – Fill	0	165,200	468,100	0	165,200	468,100	165,200	468,100
Nesting Enhancements - Fill	157,400	157,400	157,400	157,400	157,400	157,400	157,400	157,400
Imported Nesting Substrate	116,000	116,000	116,000	116,000	116,000	116,000	116,000	116,000
Fill Material to be Imported	0	0	0	0	0	0	322,600	625,500
Fill Material to be Exported	0	0	0	352,000	186,800	0	0	0
Grading Balanced On Site <sup>2</sup>	Yes	Yes	Yes	No	No	Yes	No	No

<sup>1</sup> Each scenario includes the nesting enhancements described in Alternative B.

<sup>2</sup> Clean, light-colored sand would be imported to the site under any of these scenarios.

Sources: (Ducks Unlimited 2004) and (David Cannon, Everest International Consulting, per. comm. 12/03)



public with a unique opportunity to observe and photograph the thousands of migratory and wintering birds that visit the Refuge. A reservation system would be established in association with the expansion of this program, as each tour would be limited to a maximum of 15 people.

The northern levee of Pond 11 would be opened to public access for wildlife observation and photography, in addition to shoreline fishing. The step-down public use plan discussed under Fishing would also address the design, specific location, and construction of an observation platform at the northeast end of the levee. This platform would provide opportunities for observing and photographing birds on the mudflats and adjacent river channel. Other improvements would include making the levee accessible per the draft accessibility guidelines for outdoor recreation areas proposed by U.S. Access Board and providing effective fencing to prevent public access beyond the eastern end of the levee.

To improve opportunities for wildlife observation, this alternative also includes a proposal to construct a pedestrian path along much of the southern edge of the salt works, from 7<sup>th</sup> Street to 10<sup>th</sup> Street and possibly from Florida Street to 13<sup>th</sup> Street. This pathway would be six to eight feet wide and would be constructed to the north of and parallel to the Bayshore Bikeway.

The construction of the pedestrian path would provide a number of benefits for Refuge visitors, including a safer opportunity for observing wildlife within the refuge. Currently, wildlife observers and bicyclists are sharing the same ten-foot pathway, which represents a safety issue for all users. In addition to providing a separate pathway for pedestrians, this facility would also be designed to route pedestrians away from sensitive habitat areas. Currently, to avoid conflicts with bicyclists, pedestrians often chose to walk to the north of the bike path along the edge of the salt ponds. This off-trail activity disturbs wildlife and has resulted in the loss of vegetation adjacent to the ponds. Once the ponds are restored to salt marsh habitat, the impacts of this off-trail activity would likely increase unless an alternative access route is provided (i.e., the proposed pedestrian path).

Environmental Education: Under this alternative, funding would be sought to extend the Habitat Heroes program described under Alternative A. To establish this program as a permanent part of the Refuge's environmental education program would require a long-term funding source. As part of this program, habitat restoration currently being implemented on the Refuge along the Bayshore Bikeway would be expanded to include additional areas of upland located between the Bayshore Bikeway and the Otay River channel.

This alternative also includes a proposal to partner with other agencies and non-governmental organizations to create and identify funding for an interagency environmental education coordinator for the South Bay. The establishment of such a position within the South Bay would ensure coordination among the various environmental education programs in the area.

Environmental Interpretation: Under this alternative, the Service would partner with other agencies to develop a coordinated interpretive program for San Diego Bay. Such a program would involve collaboration among all of the agencies surrounding the Bay including the Cities of Coronado, Imperial Beach, National City, Chula Vista, and San Diego, the County of San Diego, the U.S. Navy and the Port. Refuge staff would work with

these agencies to ensure that some signage is devoted to interpreting bay habitats and Refuge resources.

### **Other Public Uses**

Otay Valley Regional Trail: The eastern end of the South San Diego Bay Unit (specifically, the Otay River floodplain) is included within the approved planning boundary of the Otay Valley Regional Park (OVRP). The planning boundary, which was approved prior to establishing the South San Diego Bay Unit, encompasses more than 8,000 acres, and extends about 13 miles inland from the southeastern edge of the salt ponds at the mouth of the Otay River to the land surrounding both Lower and Upper Otay Lakes. The OVRP is a multi-jurisdictional planning effort by the County of San Diego and the cities of San Diego and Chula Vista. A Concept Plan for the OVRP was approved by the participating agencies in May 2001 (*County of San Diego 2001*).

One of the components of the OVRP, as described in the Concept Plan, is a proposal to create a regional trail through the Otay River Valley. The trail would extend east/west from the eastern planning boundary, where the trail would travel through portions of the San Diego NWR, to the Bayshore Bikeway located to the west of I-5. To facilitate the completion of this regional trail, this alternative includes a proposed alignment for the trail through the eastern end of the South San Diego Bay Unit (see Figure 2-9). the alignment proposed under this alternative would extend west from the I-5 bridge, north of the river channel, then travel northwest along the eastern border of the South San Diego Bay Unit for approximately 2,000 feet (refer to Figure 2-9). When constructed, the trail would connect to the proposed Bayshore Bikeway near the northeastern corner of the Refuge.

The City and County of San Diego are currently studying a variety of potential alignments for the Otay Valley Regional Trail that differ from the alignment shown on Figure 2-9. However, the alignment illustrated in Figure 2-9 continues to be included here in the event the other alignments prove not to be feasible. One alignment under consideration would take the trail under the I-5 bridge then turn south using land owned by the City of San Diego. Another alignment being studied would use the existing “paper streets” (undeveloped streets created through a subdivision map that are owned in fee title by the City of San Diego and located outside of the Refuge boundary) that extend from the I-5 bridge westward almost to the existing bicycle path in undeveloped Saturn Boulevard. A small area of Refuge land would have to be crossed to make the connection to the existing bike path.

At this writing, the exact alignment of the trail is still being worked out with the various agencies involved in implementing the OVRP. To facilitate impact analysis and completion of a Compatibility Determination, the alignment shown in Figure 2-9 is the alignment included as part of Alternative C. If a different alignment is selected that incorporates Refuge land, additional analysis and review in accordance with the Service’s Compatibility Policy may be required.

If it is ultimately determined that some or all of the trail would be located on Refuge land, the local agencies participating in the development of the OVRP would be responsible for obtaining approval from the Refuge Manager prior to constructing, funding, and installing the trail in accordance with the stipulations described in the Compatibility Determination for a Regional Trail (Appendix K). The OVRP would also be responsible for maintaining the trail and associated amenities such as fencing and signage; monitoring trail use; and patrolling the trail to ensure compliance with established trail regulations. If constructed,

the trail would provide additional opportunities for wildlife observation and environmental interpretation on the Refuge.

### **Other Uses**

**Solar Salt Production:** This alternative assumes that solar salt production would continue within a reduced footprint under either of the restoration options presented for the salt works. Modifications to the current pond configuration within the eastern portion of the salt works would most likely be required to facilitate efficient salt production within the reduced footprint. The existing tide gate would also be relocated from Pond 10 to one of the remaining ponds located to the east of the river channel. A revised Refuge Special Use Permit for salt production would include conditions to ensure the protection of the restored wetland areas, as well as conditions related to the protection of endangered and threatened species and other trust resources supported within the Refuge.

### **Environmental Contaminants**

Prior to initiating any restoration actions, the contaminant investigations and/or baseline sampling recommendations included in the CAP would be completed and proposed remediation actions would be implemented prior to or in association with restoration.

### **Cultural Resource Management**

The salt works, including the levees, ponds, stacks of salt near the processing plant, and the interrelationship of all of the phases of solar salt pond production have been determined to be historic properties. Therefore, prior to restoring the ponds an analysis would be completed in accordance with NHPA to determine the potential effects of pond restoration on the use, design, and function of the salt works. Under Salt Works Restoration Option 2, a treatment plan would also be prepared and implemented for mitigating adverse effects to historic resources caused by the proposed restoration activities.

Cultural resource surveys conducted within the Otay River floodplain have identified archaeological sites and others may be present. One site that has already been recorded will need to be evaluated for eligibility to the NRHP. The eligibility determinations, assessment of project effects, and treatment plans would involve consultation with SHPO and other interested parties.

In completing these actions, the Service would work with federally recognized Tribes, historical societies and museums, the SHPO, and other interested parties. Native American Tribes, Groups, and direct lineal descendants that may be affiliated with the Refuge lands would be identified and a Memorandum of Understanding with the appropriate Native American groups would be created to establish procedures for implementing the inadvertent discovery clause of NAGPRA.

### **Step-Down Management Plans**

#### **Fire Management Plan**

Implementation of either of the restoration options for the Otay River floodplain would restore weedy upland vegetation to native habitat, which would reduce the need for some of the fire suppression activities described in the fire management plan. All other aspects of the fire management plan, as described in Alternative A, would be unaffected by the proposals included in this alternative.

### **Predator Management Plan**

The predator management activities described in Alternative A for the Sweetwater Marsh Unit would also be implemented under this alternative. In addition, to avoid increases in predation following restoration, several additional measures would be implemented under this alternative. These include installing additional fencing, where appropriate, on the salt pond levees to reduce access into the area by mammalian predators and constructing artificial nesting platforms in restored marsh areas to provide cover for roosting and nesting clapper rails.

### **2.3.2.4 Alternative D – Preferred Alternative: Expand Habitat Management, Enhance Nesting Opportunities, Maximize Habitat Restoration, and Provide Additional Public Use Opportunities**

Alternative D (Figure 2-14) proposes to enhance opportunities for seabird nesting, restore native habitat in the Otay River floodplain, improve habitat quality for listed species, and restore tidal circulation within the majority of the salt ponds in the South Bay. Those ponds that are not breached would be maintained in their current configuration and the water in the ponds would be managed to support a variety of migratory birds and wintering waterfowl. The rationale for this alternative, which maximizes opportunities for habitat restoration, reflects the need to restore sensitive coastal habitats within San Diego Bay, while also maintaining those aspects of the existing salt pond system that support nesting seabirds and other migratory birds. The salt ponds and associated levees currently provide foraging, roosting, loafing, and nesting habitat for a variety of avian species; however, habitat for most other wetland or aquatic species is limited, particularly for fish and benthic invertebrates. Implementation of this alternative would increase the habitat value in the South Bay for a wide variety of organisms. Further, the proposal to restore significant areas of cordgrass within the South Bay would implement one of the recovery actions of the Light-footed Clapper Rail Recovery Plan (USFWS 1985). With respect to public use, this alternative proposes to expand the current public use program by providing new opportunities for wildlife observation and environmental interpretation around the perimeter of the Refuge Unit.

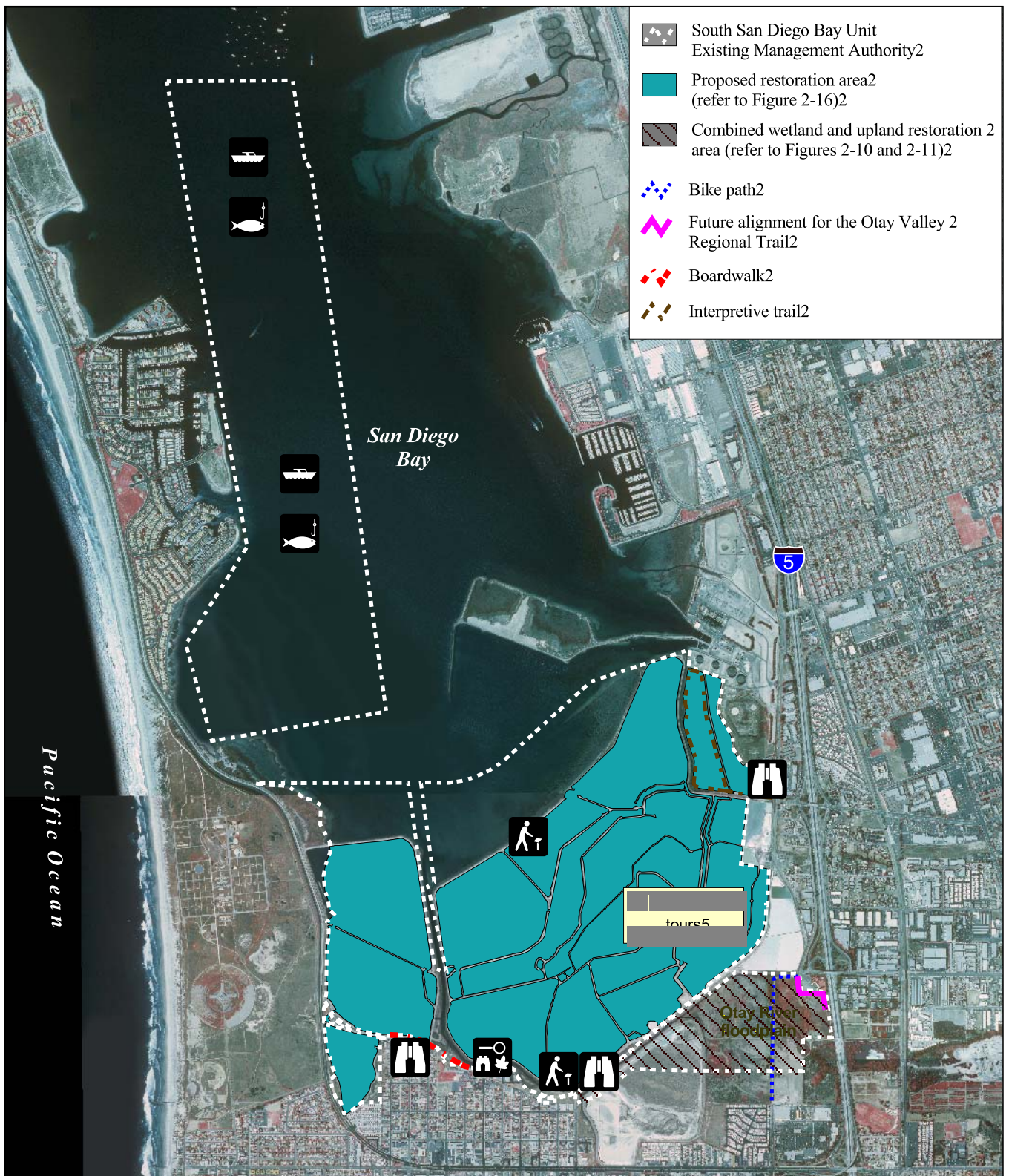
Before this alternative could be implemented, it would be necessary to: identify funding to facilitate step-down planning for the restoration and public use proposals included under this alternative (e.g., final restoration/engineering plans for the salt ponds and Otay River floodplain); prepare environmental documentation necessary to address any issues raised during step-down planning; obtain required permits and approvals; and secure funding for implementation.

### **Wildlife and Habitat Management**

While the primary focus of this alternative is the restoration of the majority of the salt ponds to tidal influence, it also includes other important aspects of Refuge management, such as maintaining the levees for seabird nesting and managing water and salinity levels in some ponds to provide habitat and foraging opportunities for migratory birds. Monitoring would also be an important aspect of refuge operations following restoration.

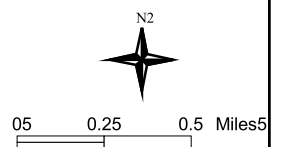
### **Habitat Restoration**

Pond Restoration: Under this alternative, Ponds 10A, 10 through 15, 23, 24, 25, 28, 29 and 30 would be restored to tidal influence, facilitating the restoration of approximately 650 acres of intertidal wetlands (Figure 2-15). Several implementation scenarios are addressed, including restoring the entire salt pond complex in a single action and implementing restoration through a phased approach. To restore tidal action to the individual ponds, one or more breaches would be made in the outer pond levee.



**Figure 2-14**  
**South San Diego Bay Unit, Alternative D**

boating  
 fishing  
 observation  
 environmental education  
 interpretive trail



Source: Local Agency Partnership (2 ft imagery, year 2000)

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The portions of the levees that are not affected by breaching would be maintained to protect seabird nesting areas. Those ponds that are not restored to tidal influence would be managed to regulate water and salinity levels to support migratory birds, particularly shorebirds and waterfowl.

The types of habitats and potential acreages that could be restored within the salt ponds under this alternative are presented in Table 2-12. These habitat acreages are provided to facilitate environmental analysis of future pond restoration. The actual mix of habitat types and total acreage of each would be determined during subsequent detailed restoration planning. This alternative also includes the habitat restoration proposals for the Otay River floodplain, which are described in Alternative C. Potential habitat acreages for restoration within this portion of the Refuge Unit are provided in Table 2-7.

Table 2-12 Habitat Acreages Within a Restored Salt Works (Alternative D)								
Habitat Types (Acres) <sup>1</sup>								
Shallow subtidal	Intertidal mudflat	Cordgrass-dominated salt marsh	Pickleweed-dominated salt marsh	<u>Levees around restored ponds</u>	Managed water area <sup>2</sup>	Brine production area <sup>2</sup>	New nesting habitat	Active salt ponds
44	124	447	32	<u>86</u>	<u>240</u>	<u>50</u>	36	0

<sup>1</sup> These acreage figures are subject to change during detailed restoration planning and are provided here to facilitate the analysis of potential impacts as a result of manipulating existing pond elevations and restoring tidal influence to various salt ponds.

<sup>2</sup> Acreages include the adjacent levees.

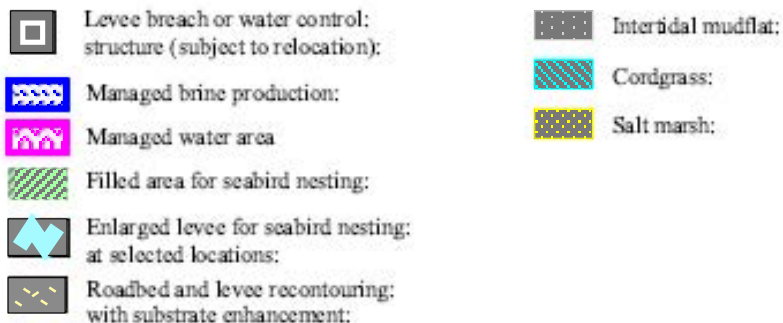
To achieve the desired habitat types presented in Table 2-12, modifications to the current pond system would be required, including grading (cutting or filling) to adjust the elevations within the ponds, breaching the pond levees, and potentially reconfiguring some of the ponds proposed for water or brine management. Such modifications include:

- Recontouring the bottom elevations of Ponds 10A and 10 through 13 as described in Alternative C, Salt Works Restoration Option 2;
- Retaining the existing elevations in Ponds 14 and 15 to support intertidal mudflat habitat;
- Lowering the elevations in portions of Ponds 23, 24, and 30 to support cordgrass-dominated habitat;
- Recontouring Pond 25 through a combination of lowering higher areas and filling lower areas to achieve elevations suitable for the establishment of cordgrass and other desired intertidal habitats;
- Removing gypsum and crystallized salt from Pond 28 and if necessary lower the pond elevations to support intertidal mudflat habitat;





**Figure 2-150**  
**South San Diego Bay Unit, Alternative DO**  
**Salt Works Restoration Proposal**



Note:

1. Intensive water management for water birds is proposed.
2. Ponds would be graded to optimize cordgrass habitat for the Light-footed Clapper Rail.
2. Pond elevations could be altered to achieve desired habitat types.
3. Specific locations and sizes of proposed seabird nesting improvements to be determined.
4. No salt production.
5. Pond 20 managed for western snowy plover nesting.
6. Restoration of the northwest corner of Pond 11, which is owned by the U.S. Navy, would require approval from the Navy prior to implementation.



Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)

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- Removing gypsum and crystallized salt from Pond 29 and if necessary lower the pond elevations to support pickleweed-dominated salt marsh habitat;
- Breaching the levees of the ponds proposed for restoration to facilitate tidal exchange;
- Retaining the general configuration of the levees around the various ponds to support seabird nesting;
- Installing new hydraulic structures to facilitate the movement of bay water through Ponds 20, 21, 22, 26, 27, 41, and 48 to allow seasonal control of water levels;
- Installing new hydraulic structures to convey water through Ponds 42, 43, 45, 46 and 47 for the purpose of achieving a salinity range that would support brine invertebrates;
- Modifying the channel that flows between Ponds 27 and 41 to provide a connection into the existing Palomar drainage channel, which extends between Ponds 15 and 28; and
- Filling Pond 44 and portions of other ponds to create a minimum of 36 acres of new opportunities for seabird and shorebird nesting.

Substrate analyses of the existing sediments within the ponds, as well as any material to be imported from the Otay River floodplain, would be completed to determine the suitability of the sediments for salt marsh restoration before any excavation occurs within the ponds. This analysis would consider such factors as grain size, salinity levels, organic content, and available nutrients. Analyses of contaminant levels, if any, within these substrates would also be conducted. After grading and dredging have been completed and the desired pond elevations and sediment composition are achieved, the levees would be breached to facilitate the natural recruitment of plants and animals. Some plant species, such as cordgrass, may be reintroduced into particular ponds to accelerate plant establishment. This process would occur after the soils within the ponds are properly consolidated and would involve transplanting plugs of cordgrass from nearby sources to the designated ponds. Once established, these specimens would be expected to spread into other areas of the ponds where appropriate elevations and tidal influence exist to support cordgrass habitat.

To facilitate impact analysis at the program-level, an analysis of potential grading requirements was conducted based on the preliminary restoration design illustrated in Figure 2-15. The optimum elevations for achieving each habitat type were used to estimate the grading requirements in each pond to be restored. As a result of this preliminary engineering, it was determined that the grading required to achieve the optimum elevations within the ponds would generate an estimated 165,700 cubic yards of excess material (Ducks Unlimited 2004). This dirt would have to be exported from the Refuge to an appropriate disposal site. The estimated cut and fill volumes associated with achieving the desired elevations in each of the affected ponds is presented in Table 2-13. As described under Alternative C, there are opportunities for achieving a better grading balance throughout the restored pond system by excavating or filling to the upper or lower range of a habitat type. More precise cut and fill estimates would be developed in association with detailed restoration planning.

The grading estimates provided in Table 2-13 do not take into consideration the type of material present in the ponds. Specifically, Ponds 25, 28, and 29 may include a gypsum crust or irregular gypsum formations. This material may not be considered acceptable fill for placement in other ponds. Material that is not acceptable for disposal in other locations within the Refuge would have to be exported offsite to an approved disposal site. Additional information regarding the soils and other materials present in the ponds would be obtained in association with the development of final restoration plans.

<b>Table 2-13</b> <b>Estimated Cut and Fill Volumes (cubic yards)</b> <b>for Obtaining the Proposed Pond Elevations Under Alternative D</b>										
Pond #	2.9 feet NAVD88 (intertidal mudflats)			3.4 feet NAVD88 (cordgrass-dominated salt marsh)			3.9 feet NAVD88 (pickleweed-dominated salt marsh)			Pond Net
	Cut	Fill	Net	Cut	Fill	Net	Cut	Fill	Net	
10	(2,600)	100	(2,500)	(77,300)	700	(76,600)	(6,400)	300	(6,100)	(85,200)
10A	-	-	-	(20,800)	-	(20,800)	-	-	-	(20,800)
11	-	-	-	(1,200)	272,500	271,300	(100)	-	(100)	271,200
12	-	-	-	(2,300)	193,900	191,600	(700)	100	(600)	191,000
13	-	-	-	(10,400)	88,400	78,000	-	-	-	78,000
14	(1,800)	6,000	4,200	-	-	-	-	-	-	4,200
15	(1,400)	28,500	27,100	-	200	200	-	2,400	2,400	29,700
23	-	-	-	(149,400)	1,300	(148,100)	-	-	-	(148,100)
24	-	-	-	(192,900)	100	(192,800)	-	-	-	(192,800)
25	-	-	-	(15,600)	8,000	(7,600)	-	-	-	(7,600)
28	(71,100)	-	(71,100)	-	-	-	-	-	-	(71,100)
29	-	-	-	-	-	-	(104,700)	-	(104,700)	(104,700)
30	-	-	-	(109,500)	-	(109,500)	-	-	-	(109,500)
Total	(76,900)	34,600	(42,300)	(579,400)	565,100	(14,300)	(111,900)	2,800	(109,100)	(165,700)

Source: Ducks Unlimited 2004

**Managed Water Area:** The existing water conveyance system within the salt works would be modified to facilitate the flow of bay water through Ponds 20, 21, 22, 26, 27, 40, and 48. Through a combination of gravity movement and pumps, water from the bay would flow into the system via a pipe or channel extended through Pond 23 and emptying into Pond 22. Screening would be installed at the intake system to restrict the introduction of fish into the managed ponds. The water in the ponds would be managed to ensure that salinity levels in the ponds would remain consistent with salinity levels in the bay. In addition, the water levels in the ponds would be regulated throughout the year to support the foraging and loafing activities of migratory birds. In some ponds, water levels may be lowered during the nesting season to provide suitable nesting habitat for western snowy plovers.

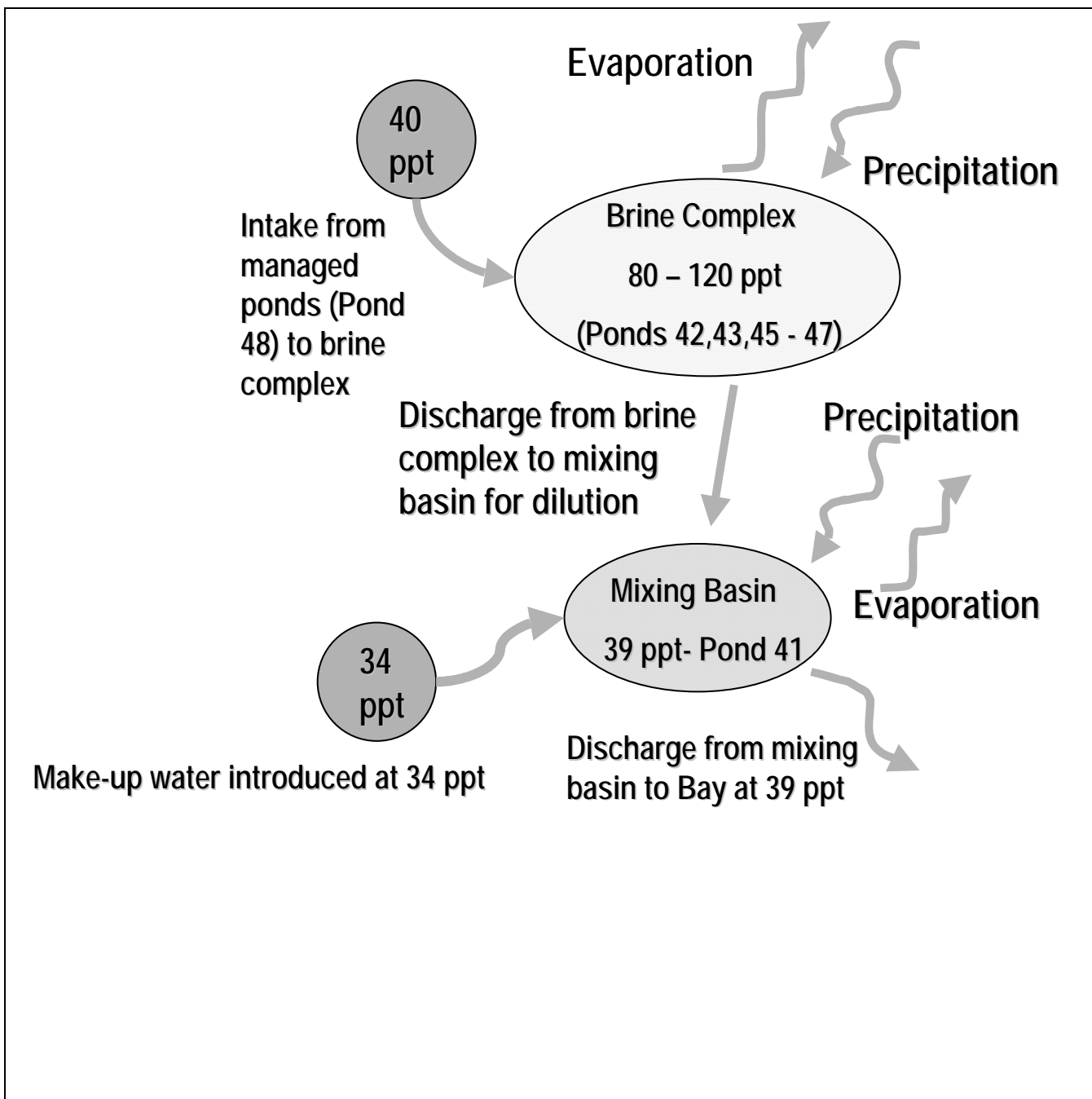
The salinity levels within these ponds would be maintained at no greater than 40 ppt. Discharge from these ponds could either be moved into the brine management area (described below) or diluted back to a salinity level acceptable for discharge into the bay. The manner in which the discharge is handled would depend upon the needs of the water management system at the time of proposed discharge.

**Brine Production Area:** Ponds 42, 43, 45, 46 and 47 would be managed to maintain salinity levels in the range of 60 to 120 ppt for the purpose of continuing to provide a source of

brine invertebrates, particularly brine flies (*Ephydra sp.*) and brine shrimp, for those birds that currently utilize this resource at the salt works. To achieve this hypersaline environment, inflow to the brine ponds would be supplied from the managed water area. The salinity of the inflow water is expected to be about 39 ppt. Once the water is moved into the brine ponds, the salinity levels would be permitted to increase through evaporation until a salinity range appropriate for supporting brine invertebrates is achieved. The proposed brine management system was modeled to assess the feasibility of maintaining desired salinity ranges within the system and the feasibility of adequately reducing the salinity level in discharge water to levels appropriate for discharge into the bay (*Philip Williams & Associates and DHI Water & Environment[PWA and DHI] 2003*). The results of this modeling indicate that the desired salinity range could be maintained through modest pumping rates. The model assumes that as water is pumped into the brine management system, the higher salinity brine water would be pumped out, with pumping rates expected to vary from approximately 60 gallons per minute (gpm) in the winter to 170 gpm in the summer. The highest salinities within these ponds (approximately 120 ppt) would occur in the late fall. During the late winter and early spring, salinities are expected to drop to about 80 ppt.

Moving water through the system would necessitate discharging the excess water back into the bay; therefore, the salinities in the discharged water would have to be reduced to an acceptable level of no greater than 39 ppt. Two methods for achieving acceptable salinity levels in water discharged from the system were analyzed (*PWA and DHI 2003*). The first method would involve using one of the ponds as a mixing basin to dilute the hypersaline water to 39 ppt prior to discharge, while the other method would involve flash mixing. Under the first method, the hypersaline water would be discharged into a mixing basin (most likely Pond 41) where bay water or water from the tidal ponds with salinity levels of 34 ppt or lower would be added to achieve a discharge salinity of 39 ppt (Figure 2-16). Once the desired salinity is achieved, water from this mixing basin would be discharged into the existing water flow channel located between Ponds 27 and 41. This channel would be modified to allow the water to flow from the channel into the existing drainage that extends between Ponds 15 and 28. Modeling indicates that the flow rate into the mixing basin would peak at about 1,330 gpm. Approximately 900 gpm would be needed to dilute the brine effluent to discharge levels and the remaining 430 gpm would be required to offset the effects of evaporation within the mixing basin. These pumping rates could be reduced by diluting the brine discharges with flash mixing, in which brine outflow is rapidly diluted in a small basin or channel prior to discharge into the bay. Flash mixing requires smaller flow rates since the effects of evaporation on a small pond surface area are negligible. The channel located between Ponds 27 and 41 provides a possible location for flash mixing (*PWA and DHI 2003*). Additional modeling and analysis would be completed as part of final engineering and restoration design to determine which method would be the most appropriate for this situation.

Water Management Plan: The managed water system would provide benefits for benthic organisms provided pond salinities are maintained at or near bay salinities. The brine management ponds would lack most macro algae and salt marsh vegetation, but would sustain hypersaline phytoplankton and brine tolerant invertebrates. As part of final restoration planning, a water management plan would be prepared to establish the operating, maintenance, and monitoring activities and associated costs required to maintain these managed water systems. This step-down planning process would also provide the opportunity to re-evaluate and/or refine water management options.



**Figure 2-16**  
**Conceptual Layout of the Brine Management Ponds**  
**and Discharge System under Alternative D**

Source: Philip Williams & Associates and DHI Water & Environment 2003



Operation and maintenance activities to be addressed in the water management plan include levee maintenance, water management, equipment and structure repair and replacement, and compliance with discharge requirements. The water management plan would include an initial intensive monitoring program to: 1) establish predicted salinity changes in the ponds under varying seasonal and climatic conditions; 2) verify the predictions of previous modeling regarding the optimal amount and rate of water exchange between the bay and the water management ponds to maintain appropriate salinity levels in the ponds and at the discharge point; and 3) identify any unexpected issues related to water management, such as bacterial growth and prolonged residence times. The data obtained during the initial establishment of the managed water areas would provide information necessary to confirm that the system can be operated as proposed or that changes through adaptive management would be necessary to achieve desired habitat objectives. Long term monitoring of the operating system and habitat values would also be implemented to enable Refuge staff to identify any changes in the system over time.

**Nesting Areas:** The actions described in Alternative B for increasing nesting opportunities for seabirds and other nesting birds would also be implemented under this alternative. In addition, Pond 44 would be filled to create a nesting area surrounded by the managed water and brine production areas. A minimum of 36 acres of nesting habitat would be provided under this alternative. An undetermined amount of additional nesting acreage would be provided through levee widening, as described in Alternative B. The volume of fill required to construct the 36 acres of nesting habitat and the estimated volume of sand required for capping these areas are presented in Table 2-14.

Table 2-14 Estimated Volume of Fill Material Required to Create the Nesting Areas Shown in Figure 2-15							
Location of New Nesting Area	Pond Elevation	Fill Elevation	Fill Area (Acres)	6-Inch Substrate Cap		3-Foot Substrate Cap	
				Base Fill Volume (cubic yards)	Substrate Volume (cubic yards)	Base Fill Volume (cubic yards)	Substrate Volume (cubic yards)
Pond 12	1.5	8.5	5.5	52,800	4,400	31,900	25,300
Pond 14	1.3	8.5	8.9	86,800	7,200	52,200	41,700
Pond 15	1.5	8.5	7.9	74,000	6,400	43,800	36,600
Pond 44	8.3	10.2	14.1	15,900	11,400	-	27,200 <sup>1</sup>
<b>Total</b>	- -	- -	36.4	229,500	29,400	127,900	130,800

<sup>1</sup>Approximately one foot of capping is proposed for the nest site at Pond 44.

Source: Ducks Unlimited 2004

Additional areas of intertidal wetlands, freshwater marsh, and upland habitats would be provided within the Otay River floodplain, as described in Alternative C. The specific acreages to be provided would depend upon which Restoration Option is selected for implementation (refer to Table 2-7 for more detail).

#### Construction Methods

The description of earthwork methods, construction equipment required, construction access routes, and locations of staging areas would be the same as those described in Alternative C for the restoration of the salt works and the Otay River floodplain and those



described in Alternative B for nesting habitat enhancements. Land alteration required to create the managed water and brine production areas would be minimal.

Levee Maintenance and Protection: As described for Alternative C, levee protection measures would be provided for the southern levees of Ponds 20, 22, and 48 to minimize the potential for levee failure during a significant flood event. To provide a conservative assessment of the potential impacts that could result from the installation of levee protection measures, the project description includes the assumption that the length of the levee along these ponds would be protected with a stone revetment. This revetment, which would extend from the top of the levee to an appropriate depth below the channel bottom, would be covered with geotextile-reinforced soil and revegetated with native plants to soften the appearance of this feature.

Also as described in Alternative C, the levees within the salt pond complex would be retained in their concurrent configuration. The only changes proposed include the reinforcement described above, the enhancements proposed to improve the habitat quality for nesting seabirds, and the occasional breaches in the levees to facilitate tidal circulation. Some of these breaches may be bridged to maintain access to outer levees for maintenance, monitoring, law enforcement, and specific public uses. Because of the potential for erosion, particularly to the outer levees, from wind, wind-generated waves, and tidal currents moving in and out of the ponds, the levees would require routine monitoring and occasional maintenance to ensure the long-term stability of the levees.

Construction Phasing: Various scenarios for implementing restoration within the salt pond complex are presented below. This section describes the construction phasing and grading and engineering activities that would be required to implement the various scenarios. A more comprehensive discussion of how restoration of the salt ponds could be phased under the preferred alternative is provided in Appendix D (CCP Implementation). None of these scenarios could be implemented until a final restoration design is completed, appropriate environmental documentation is prepared, and required permits are obtained.

Implementation of the proposed salt pond restoration could occur under several scenarios. The first involves construction that is implemented in accordance with the physical and biological constraints of the site. This scenario assumes that funding is available for the entire project at the time restoration is initiated. Restoration under this scenario would take from six months to 22 months to complete, depending upon the size of hydraulic equipment used to restore the ponds. Under the second scenario, restoration actions would be implemented in several phases or increments and would also facilitate the phased closure of the existing commercial solar salt operation.

A third scenario could be implemented if the Service were to be faced with the unanticipated shut down of the solar salt operation prior to completing final restoration plans. As described in Alternative A, circumstances beyond the control of the Service could result in the closure of the salt works. Under this situation, the Service would have to initiate actions to prevent the buildup of excessive salinity levels in the ponds. Such actions could include moving the water in the ponds in a manner that would permit discharge from the system back into the bay or breaching the pond levees to permit tidal exchange. Scenario 3 addresses the latter action and assumes that in this situation no changes to the existing pond elevations would occur. In the event that the operator of the salt works decides to cease current operations before the Service is ready to implement restoration and another operator cannot be identified to take over solar salt production, the

breach-only option included under this alternative would provide a cost effective solution for managing the ponds in the absence of salt production (refer to Section 2.3.2.1). This option would not however provide the benefits to the light-footed clapper rail that would be realized under scenarios 1 or 2.

Under any of these scenarios, monitoring of the restored areas would be a key element of the overall restoration project. While monitoring under Scenarios 1 or 3 would focus more specifically on data collection and observations made of the overall restoration project, Scenario 2 would include opportunities for implementing monitoring protocols following the completion of individual increments of the overall restoration plan. Additional details regarding these scenarios are presented below. Note that these descriptions are based on preliminary restoration planning, therefore, the specifics of how each scenario would be implemented is subject to change following the completion of detailed restoration plans for the salt pond complex.

Construction Phasing Scenario 1 - Under this scenario, new nesting areas, as described under Alternative B, would be constructed within the appropriate ponds prior to the nesting season. Once completed, the tide gate in Pond 10 that allows bay water to flow into the salt pond system would be closed and Ponds 10A, 10 and 11 would be drained further into the system, as described in Salt Works Restoration Option 1 in Section 2.3.2.3. The water in the western ponds could be transferred into Pond 12 using the existing siphon or a temporary pump. The elevations in the ponds would then be adjusted (through cutting or filling) as described in Salt Works Restoration Option 1. Once the sediments within the ponds have settled, the outer levees of Ponds 10 and 11 would be breached to allow for tidal exchange. The internal levees within Ponds 10A and 10 would also be breached to improve tidal circulation within the breached ponds.

If it is not possible to drain these ponds further into the salt production system, the pond elevations would likely be recontoured while the ponds still contain water. This would require the use of hydraulic equipment. To remove fine sediments from the tail water discharge, a weir or series of weirs would be installed to allow excess water to be discharged to the bay, while containing the sediments within the pond. Once the sediments have adequately settled, the levees would be breached to facilitate tidal exchange.

While grading is occurring in the western ponds, the remaining primary ponds, Ponds 12, 13, 14 and 15, would be drained of their high salinity water. Once again, the ponds could be emptied by either passing the brine (water with salinities higher than bay water) further into the system or by releasing the brine into the bay through levee breaching. Following draining, Ponds 12 and 13 would be recontoured to achieve the desired elevations. No changes in elevation are proposed in Ponds 14 and 15.

The brine in Ponds 23, 24, 25, 28, 29 and 30 would be moved further into the system or discharged into the bay while grading is being completed in the remaining primary ponds. Once drained, grading or dredging to achieve the desired pond elevations would be implemented. At this point, the salt works would be preparing for its final salt harvest and the remainder of the ponds would be emptied as the brine is moved into the crystallizer ponds. During this time, it would be necessary to establish an interim brine invertebrate production area, possibly in Pond 20 or a portion of Pond 22, to ensure the continued production of brine invertebrates for the migratory birds that currently utilize this resource.

Upon removal of the brine from Ponds 20, 21, 22, 26, 27, 41, and 48, this system of ponds would be isolated from the rest of the system to create a managed water area. The bay water that would be pumped through these ponds would likely enter the system via a connection through Pond 23. The water would then exit the system from Pond 27 or 41, where it could be discharged back into the bay or pumped into the brine production ponds.

All remaining salt in Ponds 42 through 47 would be harvested and processed for commercial sale or removed to an appropriate disposal site. Salt that is not harvested from Pond 44 would remain in place since this pond would be filled to create nesting habitat. Ponds 42, 43, 45, 46, and 47 would be isolated into a contained system where hypersaline conditions would support brine invertebrate production. Discharge into the bay from this system would be accomplished as described under Brine Production Area, above.

Implementation of Alternative D under this scenario would be expected to take approximately two construction seasons to complete. Physical and biological monitoring of the restored system would be implemented to evaluate performance, verify outcomes, and anticipate management improvements.

Construction Phasing Scenario 2 - Under Scenario 2, restoration of the salt pond complex would occur in phases beginning with the restoration of western ponds followed by the phased restoration of the eastern ponds. Details regarding timing and the various management actions that would be implemented through this phased approach are provided in Appendix D (CCP Implementation). The specific details described in Appendix D are subject to change or refinement during step-down planning. Revisions to the phasing plan may be prompted by new information regarding the site or sensitive resources, changes in funding availability, and/or recommendations made following the completion of detailed site analysis (e.g., hydrological modeling, soils analysis, contaminants sampling, biological monitoring results). The anticipated construction-related activities associated with the implementation of scenario 2 are addressed below.

The first phase of construction would involve the western ponds, with Pond 11 to be restored first, followed by Ponds 10 and 10A. To do this, the outflow of water from the western ponds to Pond 12 would require some modification prior to separating Pond 11 from the rest of the system. As part of this process, the water in Pond 11 would be moved into Pond 12 via the existing gravity flow system. Once the majority of the water is emptied from Pond 11, the pond elevations would be contoured to facilitate habitat restoration in accordance with the final restoration plans. The levee would then be breached and monitoring would begin to evaluate plant and animal species recruitment; observe the efficiency of tidal circulation and sediment and hydrological changes; record avian activity on the adjacent berms; and evaluate general achievement of restoration objectives.

The next phase would involve restoration of Ponds 10 and 10A. Scenario 2 assumes that solar salt production would continue during a phased restoration process; therefore, the eastern ponds would continue to be an active part of a reduced salt works operation until restoration of the eastern ponds is underway. As a result, the existing intake for the salt works, which is currently located in Pond 10, would have to be relocated or modified prior to separating Pond 10 from the system. Several options for redesigning the intake system would be investigated, including constructing a new tide gate in Pond 12 or modifying Pond 10 to allow water to enter the existing tide gate and immediately be directed into the

siphon that currently empties into Pond 12. Prior to removing or closing the siphon, the water in Ponds 10 and 10A would be allowed to flow into Pond 12.

Once the majority of the water is emptied from Ponds 10 and 10A, the pond elevations would be contoured to facilitate habitat restoration in accordance with the final restoration plans and a berm would be constructed around Pond 10A to prohibit tidal waters from entering adjacent properties. The levees would then be breached and monitoring would begin.

Restoration of the eastern ponds would likely begin with the construction of new nesting areas, as described in Alternative B, although this action could occur during the implementation of Phase 1. The restoration approach implemented for the western ponds may be modified for the eastern ponds if monitoring results and observations of restoration success indicate that changes are necessary to achieve restoration objectives. Ponds 12, 13, 14, and 15 would then be drained into the secondary ponds and prepared for restoration. In addition, modifications to the remaining salt ponds and the water intake system would be implemented to facilitate the continued production of salt within the smaller footprint. The intent of this phased approach assumes that solar salt production would continue beyond this phase of restoration. Brine invertebrates would continue to be an ancillary product of salt making.

If the operator determines that commercial solar salt production is not economically feasible beyond this point, no new intake would be required. Under these circumstances, the remaining brine in Ponds 12 through 15 and the secondary ponds could be moved through the system, either by the operator or entity acting on behalf of the Service, to permit the salinity levels to increase to the point at which sodium chloride would precipitate out. This salt could then be harvested and processed for sale or removed and taken to an appropriate disposal site, thus avoiding the need to discharge any brine into the bay.

Once the majority of the water is emptied from the remaining primary ponds, the pond elevations would be contoured to facilitate habitat restoration in accordance with the final restoration plans. After achieving the desired elevations, tidal circulation would be restored to the ponds and monitoring activities would be expanded to include this phase of the restoration.

The duration of time between the completion of phase 2 and implementation of the final restoration phase would depend upon any of several factors, including whether salt production has continued beyond phase 2, funding is available to implement the next phase, and/or the desired restoration objectives are being achieved in the initial restoration phases. If salt production has been abandoned, it would be necessary to implement the final phase of restoration immediately after the completion of this phase. This would be done to avoid the loss of shallow open water environments and the existing brine invertebrate resource that has been provided by the salt works operation. If salt production continues following the completion of this phase, then the implementation of the final restoration phase may occur several years later pending availability of funding for completion of the project.

The implementation of the final phase of the restoration plan would involve the breaching of Ponds 23, 24, 25, 28, 29, and 30, as described in Scenario 1. This activity would coincide with establishing managed water and brine production areas. Pond 44 would be filled to

create a new seabird nesting area. Under this scenario, if commercial salt production continues commercial solar salt production would end as the last of the salts are harvested from the remaining unbreached ponds.

**Construction Phasing Scenario 3** - The ponds proposed for tidal restoration under Scenarios 1 and 2 would also be breached under this scenario; however, the existing elevations within the ponds would not be modified. The habitats that would ultimately become established would be a function of the existing elevations within each pond. Figure 2-17 illustrates the habitat types expected under this scenario. The estimated acreage of each habitat type is provided in Table 2-15.

Table 2-15 Habitat Acreages Expected Within the Salt Ponds Under Construction Phasing Scenario 3					
Habitat Types (in Acres)					
Shallow subtidal	Intertidal mudflat	Cordgrass-dominated salt marsh	Pickleweed-dominated salt marsh	Uplands (areas above MHHW and pond levees)	New nesting habitat
45	370	70	235	300	36

Breaching could occur when the ponds are full or empty. The proposals for creating water management and brine production areas, as well as for implementing nesting enhancements, would also be implemented under this scenario.

#### Range of Restoration Options Possible Under this Alternative

Several combinations of restoration options could be implemented under Alternative D as presented in Table 2-16. Some options would result in the need to export or import material to achieve the restoration objectives. Others would result in a balanced grading scheme, eliminating the need to import or export any material other than that required for capping nest sites.

#### Habitat Management

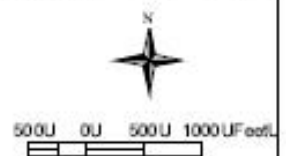
Following the elimination of the solar salt operation, the Service would have sole responsibility for maintaining the pond levees. Management actions would also be required to control unauthorized public access on the levees and within the restored salt marsh habitat. Such actions could include fencing around the eastern perimeter of the salt ponds, installing regulatory signage around the perimeter and outer levees of the Refuge, and routine visits to the area by Refuge staff to monitor the effectiveness of fencing and signage in reducing unauthorized access. In addition, the quality of the nesting habitat on the salt pond levees would be maintained by continuing to isolate nesting areas from human disturbance, ensuring that levee surfaces remain generally open with limited vegetation, and controlling vegetation on levee slopes to provide good visibility of the surrounding area for nesting seabirds. During final restoration design, consideration would be given to providing areas of unvegetated mudflat habitat adjacent to some levees with appropriate access routes maintained for foraging snowy plover chicks and subtidal areas adjacent to other levees to maintain areas of open water along some portions of the internal levees that annually support seabird nesting.





**Figure 2-17N**  
**Expected Habitats within the Salt Ponds Following Levee Breaching N**  
**with No Changes to the Existing Pond Elevations N**

Intertidal mudflat    Cordgrass    Salt marsh    Upland



Source: USFWS, Local Agency Partnership (2 ft imagery)U

Carlsbad Field Office - 2003U  
 /stem/stacey/ssdbay/fig\_4-03/figures.aprL



**Table 2-16**  
**Various Restoration Scenarios<sup>1</sup> Under Alternative D**  
**with Estimated Net Grading Requirements for Each Scenario**

Estimated Net Grading Volumes (cubic yards)	Restored Salt Ponds (Modified)	Otay Option 1 + Restored Salt Ponds (Modified)	Otay Option 2 + Restored Salt Ponds (Modified)	Restored Salt Ponds (Breach Only)	Otay Option 1 + Restored Salt Ponds (Breach Only)	Otay Option 2 + Restored Salt Ponds (Breach Only)
Otay Floodplain – Cut	0	723,000	970,000	0	723,000	970,000
Otay Floodplain – Fill	0	723,000	460,600	0	549,700	460,600
Salt Works – Cut	165,700	165,700	165,700	0	0	0
Salt Works – Fill	0	0	0	0	0	0
Nesting Enhancements - Fill	173,300	173,300	173,300	173,300	173,300	173,300
Imported Nesting Substrate	127,400	127,400	127,400	127,400	127,400	127,400
Fill Material to be Imported	7,600	7,600		173,300	0	0
Fill Material to be Exported	0	0	501,800	0	0	336,100
Grading Balanced On Site <sup>2</sup>	N <sup>3</sup>	N <sup>3</sup>	N	N	Y	N

<sup>1</sup> Each scenario includes the nesting enhancements described in Alternative B, as well as the proposal to convert Pond 44 to a nesting site.

<sup>2</sup> Clean, light-colored sand would be imported to the site under any of these scenarios.

<sup>3</sup> As described previously, the grading estimates for modifying the pond elevations can be increased or decreased to achieve a balanced grading plan without compromising the desired habitat types, therefore, it is likely that the final restoration plan for this scenario would result in a grading plan that balances the cut and fill quantities on site.

Sources: (Ducks Unlimited 2004) and (David Cannon, Everest International Consulting, per. comm. 12/03)

To be effective, the pelican roosting platforms described in Alternative A should be installed in open water areas. Because the primary and some secondary ponds would be restored to tidal action under Alternative D, the platforms would have to be moved from the primary ponds to other areas of open water. If the water is deep enough, one or two of the platforms might be relocated to the managed water area, or the platforms could be installed in the bay within the Refuge's management boundary. Additional monitoring would be required for any platforms installed in the bay to determine the extent, if any, of human disturbance on roosting pelicans.

## **Public Use Program**

### **Public Access**

Public access onto this Refuge Unit would be permitted within the open waters of the bay, through guided nature tours within the salt pond complex, and along Pond 28 via a proposed interpretive trail. Improved access around the southern perimeter of the Refuge Unit would be provided on a proposed pedestrian path, as described in Alternative C. The Refuge will work with surrounding local and state agencies to identify opportunities for providing signage that directs the public to the various public access points on the Refuge.

### **Wildlife-Dependent Recreational Uses**

Fishing: Opportunities for fishing would continue to be provided within the open waters of the bay, as described in Alternative A. The expansion of fishing opportunities as described in Alternative C are not proposed under this alternative.

Wildlife Observation and Photography: This alternative includes the opportunities for wildlife observation and photography that are currently available on the Refuge Unit via boat (refer to Section 2.3.2.1, Alternative A), through the expansion of the guided tour program for the salt pond complex, and along the pedestrian path described under Alternative C. The following additional opportunities for these uses are proposed under this alternative:

- Observation points would be established along the proposed pedestrian path at the northern terminus of 7<sup>th</sup>, 8<sup>th</sup> and 10<sup>th</sup> Streets in Imperial Beach to provide observation opportunities of bird foraging and nesting activity along the Otay River channel and Ponds 10 and 23;
- An observation area would also be provided within the upland area north of the Bayshore Bikeway in the vicinity of 13<sup>th</sup> Street in Imperial Beach to provide an overview of avian activities in Ponds 22 and 23;
- Another potential observation area could be provided along the eastern edge of Pond 29 in the City of Chula Vista, (refer to Figure 2-15), but the specifics of this proposal require coordination with the Port; and
- An interpretive trail would be constructed around Pond 28 to provide visitors within the opportunity to observe wildlife within the open bay, on the salt pond levees, and within adjacent restored salt ponds.

The observation areas proposed around the perimeter of the South San Diego Bay Unit would be located on a coastal terrace that is slightly elevated above the adjacent wetlands. From these locations, visitors would be provided with views across many of the restored

salt ponds. Nesting activities on several levees could be viewed through a spotting scope or binoculars. In addition to visual access into the Refuge Unit, these locations would also provide excellent opportunities to experience the many sounds of the Refuge, particularly the unmistakable chatter emitted from the tern nesting colonies and the vocalizations of black-necked stilts (*Himantopus mexicanus*) and other shorebirds that forage along the river channel and within the adjacent ponds.

The proposed observation points would be accessible from the Bayshore Bikeway and several public streets in northern Imperial Beach. A parking area that serves users of the Bayshore Bikeway is available at the northern terminus of 13<sup>th</sup> Street and on-street parking is available along Florence Street, 8<sup>th</sup> Street, and Boulevard Avenue. Based on preliminary concepts for the observation areas, the design for the observation points at 10<sup>th</sup> and 13<sup>th</sup> Streets and adjacent to Pond 29 would be relatively informal consisting of a leveled area with either a hardened surface or a permeable surface consisting of compacted native soil or decomposed granite. A post and cable fence or other appropriate barrier would be provided at the edge of these observation areas to minimize disturbance to adjacent vegetation. An observation deck is envisioned for the 8<sup>th</sup> Street location. This deck would serve two purposes, one related to public use and the other to reduce human disturbance within the restored salt ponds. The deck would be slightly elevated above the adjacent wetland and the railing and fencing provided around the deck would be designed to reduce accessibility from the existing bike path into sensitive habitat.

A 1.5-mile wildlife observation and interpretive trail is proposed in the northeastern corner of this Refuge Unit. The trail, which would begin near Bay Boulevard, would extend west along the Palomar drainage, then head north on the levee that separates Ponds 28 and 29. The trail would then extend around the perimeter of Pond 28, which is situated at a slightly higher elevation than the ponds to the west. From this trail, visitors would have excellent views of the open bay, restored ponds, and seabird nesting areas. The trail would be designed in a manner that would enable the Service to restrict use to specific hours and seasons, if necessary. This would likely involve the installation of fencing, a gate, and appropriate signage. Use of the trail would be restricted to pedestrians and dogs would not be permitted on the trail.

The proposal to open the northern levee of Pond 11 to public access for wildlife observation would not be implemented under this alternative.

Environmental Education: The proposals for environmental education addressed in Alternative C would also be implemented under this alternative.

Environmental Interpretation: Under Alternative D, the current public use program would be expanded to include new opportunities of environmental interpretation. These opportunities would include:

- Interpretive panels and other interpretive elements to provide information about such topics as the restored habitats within the salt ponds, migration along the Pacific Flyway, the Refuge's endangered and threatened species, and nesting seabirds;
- An interpretive trail that focuses on native vegetation and the importance of environmental education;
- A 1.5-mile interpretive trail around Pond 28;

- An interpretive program to present the history of hunting within San Diego Bay and describe the importance of hunting within the Refuge System; and
- An interpretive program to describe the historical significance of the salt pond complex and the importance of solar salt production in the South Bay.

The majority of the interpretation would be provided around the southern perimeter of the bay, where visual and other sensory access into the Refuge is readily available. In general, interpretive sites would correspond with those sites selected to facilitate wildlife observation. The majority of the proposed sites would be located along the proposed pedestrian path or the Bayshore Bikeway. Potential locations for interpretation include the area around Bayside Elementary School (at the terminus of 10th Street), the northern terminus of 8th Street, and an area located between the terminus of 13th Street and Florence Street. An initial step in creating an environmental interpretation program for the Refuge would involve the development of a step-down interpretive plan. Within the plan, the interpretive theme for each interpretive site, the types of interpretive elements to be installed, and a detailed cost estimates for each site would be identified. The step-down plan would also examine opportunities for additional interpretation at existing public use locations where interpretive elements, such as kiosks, signs, remote television cameras and other cutting edge approaches to public interpretation, could be provided.

An interpretive walk is proposed along the upland terrace near the terminus of 13th Street. This area would be restored to native upland as part of the Refuge's Habitat Heroes environmental education program. The site provides an excellent opportunity to use various interpretive elements to illustrate the importance of preserving coastal upland vegetation in proximity to coastal wetlands. The design of this pathway and the associated interpretive elements would be developed as part of the step-down interpretive plan.

Interpretation of the resources to be observed along the Pond 28 interpretive trail could be provided using various interpretive elements installed along the trail, via a trail brochure, and/or through docent-led nature tours.

The development of a program to interpret the historic hunting activities in San Diego Bay and the importance of hunting within the Refuge System is also proposed under this alternative. The program, which would address one of the traditional wildlife-dependent recreational uses of the National Wildlife Refuge System, would be conducted along the outer salt pond levees. This interpretive hunting experience would be conducted seasonally along the outer levees of the salt ponds and would describe what hunting within the South Bay habitats might have been like in the early part of the 1900s. The current opportunities for hunting within the Refuge System would also be addressed. This program would be conducted approximately four times a year between November and January and would involve up to 12 participants per session. Each session would take place between sunrise and 9:00 a.m. One or two temporary hunting blinds would be installed along the northern levee to create an air of authenticity. Participants would be transported from an off Refuge location to the salt ponds. Reservations would be required to participate; however, no fee would be collected from the participants.

To preserve the historic context of the area, an interpretive program would also be developed to present the long history of solar salt production at this location. The interpretive program would include the preservation of various elements associated with

the operation, a pictorial history of the operation over the years, and an interpretive display of artifacts from the facility. Facts about the significance of the facility to salt production in general and to the past and present economy of the San Diego region would also be provided. The primary salt processing area associated with the salt works is located on property outside the Refuge boundary; therefore, the Service would work in partnership with the Airport Authority and others to develop a meaningful interpretive program for the entire salt works facility. Portions of the Pond 28 trail might also be used to facilitate interpretation of the salt works.

### **Other Public Uses**

Recreational Boating: Recreational boating would continue to be permitted within Refuge waters, provided these activities are conducted in accordance with the existing five mph speed limit. This issue could be revisited should problems arise in the future related to wildlife disturbance from the various boating activities occurring on the Refuge.

Otay Valley Regional Trail: The proposed route for the Otay Valley Regional Trail, as described in Alternative C, is also included under this alternative.

### **Other Uses**

Refuge Facilities: This alternative includes a proposal to explore the potential for constructing a Refuge Complex office within the South San Diego Bay Unit on a 0.71-acre parcel located to the south of the Bayshore Bikeway and the east of 12<sup>th</sup> Street in Imperial Beach. Such a proposal would require coordination with the State Lands Commission and the City of Imperial Beach; the initiation of a public outreach program to obtain input from surrounding residents; and completion of required environmental documentation.

Solar Salt Production: Solar salt production would be eliminated under this alternative. The operation may be closed at the commencement of salt pond restoration or the current operation could be phased out in association with a phased restoration process (refer to the previous discussion regarding Construction Phasing).

### **Environmental Contaminants**

Prior to commencement of restoration actions on the Refuge, any contaminant investigations and/or baseline sampling recommendations included in the CAP would be completed and proposed remediation actions would be implemented prior to or in association with restoration.

### **Cultural Resource Management**

Under this alternative, the solar salt operation would be discontinued. Prior to any restoration of the salt ponds, an analysis of the effects of restoration on use, design, and function of the salt works would be completed in accordance with the requirements of the NHPA. A treatment plan for mitigating the adverse effects to the salt works caused by the proposed restoration activities would also be prepared and implemented. It is likely that the treatment plan would include a proposal to interpret the historic significance of the salt works operation; consequently, the development of such an interpretive program is included in this alternative as part of the environmental interpretation proposals (refer to the Public Use section presented above).

In addition, a cultural resource survey would be conducted of the Otay River floodplain and site testing would occur to determine the eligibility to the NRHP of sites identified during

the survey, as well as any previously identified sites that have not yet been evaluated. The eligibility determinations, assessment of project effects, and treatment plans would require consultation with SHPO and other interested parties.

As described in Alternative C, the Service would work with federally recognized tribes, historical societies and museums, the SHPO, and other interested parties in developing a cultural resources management plan for the Refuge. The plan would comply with the NHPA, NAGPRA, and other regulations and policies related to cultural resources.

### **Step-Down Management Plans**

#### **Fire Management Plan**

Implementation of either of the restoration options for the Otay River floodplain would restore weedy upland vegetation to native habitat, which would reduce the need for some of the fire suppression activities described in the fire management plan for this portion of the Refuge. All other aspects of the fire management plan, as described in Alternative A, would be unaffected by the proposals included in this alternative.

#### **Predator Management Plan**

Predator management would generally be implemented as described in Alternative A for the Sweetwater Marsh Unit. However, to address the predation issues for the listed species that would be supported in the restored portions of the Refuge Unit, the following additional measures would be implemented: install fencing along the eastern perimeter of the Refuge in the vicinity of the salt ponds to reduce the accessibility of the nesting colonies to mammalian predators; construct artificial nesting platforms in restored marsh areas to provide cover for roosting and nesting clapper rails; and experiment with various perching deterrents along the levees to reduce avian predation. A detailed discussion of the predator management plan is presented in Appendix M.

### **2.3.3 Alternatives Considered but Eliminated from Detailed Study**

The alternatives development process is designed to allow consideration of the widest possible range of issues and potential management approaches. During this process, various objectives and strategies for achieving Refuge goals were considered but not selected for detailed study. Those alternatives that were eliminated from detailed study are presented below.

#### **2.3.3.1 Additional Restoration Options for the Salt Works**

Early in the planning process, the CCP team considered a variety of restoration options for the salt works. From these, nine conceptual restoration proposals, including a no action option, were designed and presented to the public for review and comment. Of the nine options, five have been incorporated into the alternatives presented above and four were eliminated from detailed study.

The options that were eliminated included:

- Widening the existing Otay River channel between the western and eastern salt ponds to improve the conveyance of flood waters;
- Widening the river channel in combination with restoring the Otay River floodplain;
- Realigning and broadening the Otay River within the Otay River floodplain to eliminate the bend in the river and removing the levees in Ponds 10, 11, 12, and 23 and a portion of the levees from Ponds 13 and 22 to better accommodate river flows; and,



- Removing all of the pond levees to create a gently sloping marsh plain from the Otay River to the existing intertidal mudflats located to the north of the salt works.

The options related to widening the Otay River were eliminated from further study when it was determined that this change would not achieve the desired goal of protecting the salt ponds from impacts during significant flood flows in the Otay River. The realignment and broadening of the Otay River was dropped from further consideration due to the adverse impacts this proposal would have on the railroad right-of-way, which is located outside the Refuge boundaries. The restoration option involving the complete removal of the levees within the salt works would result in the loss in historical nesting habitat for least terns and a variety of colonial nesting seabirds; therefore, it too was eliminated from further study.

### **2.3.3.2 Restore Eelgrass and Mudflat Habitat Near Emory Cove**

During preliminary discussions about potential restoration options within the South San Diego Bay Unit, consideration was given to restoring a portion of a previously dredged channel leading to Emory Cove. Historic habitats considered for restoration included intertidal mudflats and shallow subtidal habitat. Filling the channel could facilitate the reestablishment of eelgrass beds and mudflat habitat in the Emory Cove area. This proposal was not studied in detail because of the need for additional coordination with other partners, as well as funding constraints. This restoration concept would likely be reevaluated in future years when the proposals in the CCP are reviewed and updated as appropriate.

### **2.3.3.3 Opening the Refuge for Waterfowl Hunting**

Hunting is one of the six wildlife-dependent recreational uses that are to receive priority consideration in Refuge planning. Opening the South San Diego Bay Unit to waterfowl hunting was initially proposed as a component of one of the management alternatives. The waterfowl areas within the Refuge are located on property owned by the State of California and leased to the Service for management as a National Wildlife Refuge. In light of the broad based concern with implementing a hunting program in proximity to urban areas, the proposal has been eliminated from further study at this time.

### **2.3.3.4 Alternative Predator Management Proposals**

Refer to Section 2.2.3.4 for a discussion of the various predator management proposals that were considered, but eliminated from further study.

## **2.3.4 Comparison of Alternatives by Issue**

Table 2-17 presents an issue-by-issue comparison of the four alternatives for this Refuge Unit.

Table 2-17  
Comparison of Alternatives for the South San Diego Bay Unit by Issue

	Alternative A	Alternative B	Alternative C	Alternative D – Preferred Alt.
Issues				
<b>Wildlife/Habitat Management</b>				
<b>Manage wintering and breeding birds as a priority</b>	<ul style="list-style-type: none"> <li>Annually monitor nesting seabirds per available funding</li> <li>Minimize human disturbance around the salt ponds throughout the year, and prohibit public use during the nesting season</li> </ul>	<ul style="list-style-type: none"> <li>Implement the proposals in Alternative A</li> <li>Enhance nesting substrate on the salt pond levees and create a minimum of 25 acres of additional nesting area in the salt works</li> <li>Seasonally regulate the water levels in Pond 20 to provide nesting and foraging habitat for western snowy plovers</li> </ul>	<ul style="list-style-type: none"> <li>Implement the proposals in Alternative B</li> <li>In association with pond restoration, maintain quality nesting habitat on the salt pond levees</li> <li>Continue solar salt production within a reduced footprint to provide a source of brine invertebrates for various migratory bird species</li> </ul>	<ul style="list-style-type: none"> <li>Implement the proposals in Alternative B (but provide at least 33 acres of new nesting area)</li> <li>Restore tidal influence to various salt ponds to benefit <u>fish and migratory birds</u></li> <li>Manage some ponds to produce brine flies and brine shrimp as prey for specific species of migratory birds</li> </ul>
<b>Restore coastal wetlands to support fish and wildlife</b>	<ul style="list-style-type: none"> <li>Implement no new restoration proposals</li> </ul>	<ul style="list-style-type: none"> <li>Implement no new restoration proposals, but provide new seabird nesting habitat</li> </ul>	<ul style="list-style-type: none"> <li><u>Restore tidal influence to between 200 and 440 acres of salt ponds</u></li> <li>Restore between 65 and 90 acres of intertidal wetlands and 35 to 60 acres of upland habitat in the Otay River floodplain</li> </ul>	<ul style="list-style-type: none"> <li><u>Restore tidal influence to 650 acres of salt ponds</u></li> <li>Restore between 65 and 90 acres of intertidal wetlands and 35 to 60 acres of upland habitat in the Otay River floodplain</li> </ul>

Table 2-17 (continued) Comparison of Alternatives for the South San Diego Bay Unit by Issue				
Issue	Alternative A	Alternative B	Alternative C	Alternative D – Preferred Alt.
<b><i>Wildlife/Habitat Management (continued)</i></b>				
<b>Protect habitat values for all species, not just listed species</b>	<ul style="list-style-type: none"> <li>Maintain current management practices</li> </ul>	<ul style="list-style-type: none"> <li>Expand current management practices to include enhancing the salt pond levees to improve the quality of nesting habitat for various seabird species</li> </ul>	<ul style="list-style-type: none"> <li><u>Restore tidal influence to salt ponds</u> while preserving/enhancing levees for seabird nesting and <u>migratory bird roosting</u> during high tides</li> <li>Restore tidal wetlands to increase habitat for fish, wildlife, invertebrates</li> </ul>	<ul style="list-style-type: none"> <li>Similar to Alternative C, but increase the number of ponds to be restored to tidal influence</li> <li>Maintain some ponds for the production of brine invertebrates to continue to support eared grebes and phalaropes</li> </ul>
<b>Restore upland and wetland habitat in the Otay River floodplain</b>	<ul style="list-style-type: none"> <li>Implement no new restoration proposals</li> </ul>	<ul style="list-style-type: none"> <li>Implement no new restoration proposals</li> </ul>	<ul style="list-style-type: none"> <li>Restore 65 acres of intertidal wetlands and 60 acres of uplands under Restoration Option 1 or 90 acres of intertidal wetlands and 35 acres of uplands under Option 2</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative C</li> </ul>
<b>Address adverse effects of predation on listed species</b>	<ul style="list-style-type: none"> <li>Implement a predator management plan to protect least terns and western snowy plovers nesting at the salt works and light-footed clapper rails active in the Otay River floodplain</li> </ul>	<ul style="list-style-type: none"> <li>Manage predators as described in Alternative A</li> </ul>	<ul style="list-style-type: none"> <li>Manage predators as described in Alternative A and added fencing as necessary to protect restored areas from intrusion by mammalian predators</li> </ul>	<ul style="list-style-type: none"> <li>Manage predators as described in Alternative A and fence the eastern boundary of the salt ponds to protect restored areas from intrusion by mammalian predators</li> </ul>

Table 2-17 (continued) Comparison of Alternatives for the South San Diego Bay Unit by Issue				
Issue	Alternative A	Alternative B	Alternative C	Alternative D – Preferred Alt.
<b>Public Use</b>				
<b>Open the salt works to public access</b>	<ul style="list-style-type: none"> <li>Continue to provide occasional guided nature tours at the salt works</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative A</li> </ul>	<ul style="list-style-type: none"> <li>Increase the number of guided nature tours at the salt works to two per month outside of the nesting season</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative C, plus develop an interpretive program to present the history of waterfowl hunting in San Diego Bay</li> </ul>
<b>Expand opportunities for priority public uses</b>	<ul style="list-style-type: none"> <li>Maintain current public uses including fishing, wildlife observation, environmental education, and boating</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative A</li> </ul>	<ul style="list-style-type: none"> <li>Expand fishing and wildlife observation opportunities by opening a levee to public access; increase guided nature tours of the salt works; accommodate a portion of the Otay Valley Regional Trail (OVRT); develop a boardwalk to the south of Pond 10</li> </ul>	<ul style="list-style-type: none"> <li>Maintain current fishing, environmental education, and boating activities; increase guided nature tours; accommodate the OVRT; and provide new opportunities for wildlife observation and interpretation at Pond 28 and around the Unit's southern perimeter</li> </ul>
<b>Permit waterfowl hunting on this Unit</b>	<ul style="list-style-type: none"> <li>Unit closed to hunting</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative A</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative A</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative A</li> </ul>
<b>Other Issues</b>				
<b>Seek management authority for all areas within the approved acquisition boundary</b>	<ul style="list-style-type: none"> <li>Continue to work with the Port to incorporate into the refuge those portions of the south bay included in the approved acquisition boundary</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative A</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative A</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative A</li> </ul>

## 2.3.5 Refuge Management Direction: Goals, Objectives, and Strategies

### 2.3.5.1 Overview

Goals and objectives are the unifying element of Refuge management. They are intended to identify and focus management priorities and provide a link between management actions, Refuge purposes, and NWRs mission and goals. For more information about goals, objectives, and strategies, refer to Section 2.2.5.

The goals for the South San Diego Bay Unit, as presented in Section 1.8.2, apply to all four of the alternatives evaluated for this Refuge Unit. The following section includes objective statements and associated strategies for each Refuge goal. The objectives have been written to address the Preferred Alternative (Alternative D). In addition, the various strategies that would implement the objective in whole or in part are provided in a table format that allows the reader to determine which strategies would be implemented under each alternative. Specific acreage figures, time frames, and other measurable elements presented in the objectives may change depending upon which alternative is finally selected for implementation.

### 2.3.5.2 Description of the Goals, Objectives and Strategies

The proposed objectives and strategies are listed below as they apply to the five Refuge goals.

**GOAL 1: Protect, manage, enhance, and restore open water, coastal wetlands, and native upland habitat to benefit the native fish, wildlife, and plant species supported within the South San Diego Bay Unit.**

***Objective 1.1: Incorporate In-holdings Into Refuge Management Area***

*Within ten years of the CCP's approval, increase the total acreage of the Refuge to approximately 3,400 acres by incorporating into the Refuge most of the open water areas of the bay currently included within the approved acquisition boundary.*

**Rationale:** Much of San Diego Bay's shallow water environment, including eelgrass beds, has been eliminated over the years due to urban development. Of the shallow water habitat that remains, the vast majority is located in the southern end of the bay, where some, but not all, is included within the current boundary of the South San Diego Bay Unit. Approximately 1,000 acres of shallow water habitat are included within the approved Refuge acquisition boundary, but have yet to be leased to the Service for management. As a result, wildlife needs in these areas are not actively protected from disturbance. Extending the Service's management authority over these remaining areas would ensure uniform enforcement of existing regulations, such as the 5-mile per hour speed limit, to minimize disturbance to wildlife and protect sensitive eelgrass beds that support migratory birds, fish, and several listed species, including the California least tern and green sea turtle.

Objective 1.1 - Incorporate In-holdings Into Refuge Management Area				
Comparison by Alternative				
Alternative				Strategy
A	B	C	D	
✓	✓	✓	✓	Continue working with the Port to obtain a lease or management agreement for approximately 1,000 acres of the open bay included within the approved acquisition boundary but not yet included within the Refuge boundary.

***Objective 1.2: Restore Native Habitats in the Otay River Floodplain***

*When funding is available, restore the Otay River floodplain to a mix of a minimum of 65 acres of intertidal wetlands (consisting of 50 percent intertidal mudflat, 30 percent cordgrass-dominated salt marsh, and 20 percent pickleweed-dominated salt marsh), at least 15 acres of freshwater wetland habitats (containing a mix of freshwater marsh, riparian scrub, and riparian woodland vegetation), and a minimum of 35 acres of native uplands (consisting of 50 percent perennial native upland shrub species and less than five percent cover of exotic species) to support native wetland and upland species.*

**Rationale:** The Otay River floodplain has been subject to human disturbance associated with solar salt production, agriculture, and public utilities for more than 100 years. As a result, the only native habitats present are the narrow areas of southern willow scrub and pickleweed-dominated salt marsh that occur along the edges of Otay River channel. In its current state, this area represents an excellent opportunity for restoring the variety of native habitats that occurred here in the past. Restoration to provide freshwater wetlands, native upland, and intertidal habitat would support the Refuge purpose of protecting and restoring habitats for federally-listed endangered and threatened species and migratory birds. This proposal is also consistent with 1) the recommendations of the Southern Pacific Shorebird Conservation Plan (Hickey et al. 2003), which calls for the restoration of tidal flats and marshes on the southern California coast; 2) the management actions of the Light-footed Clapper Rail Recovery Plan (USFWS 1985c), which identifies the need to improve tidal action at the Otay River mouth and expand nesting habitat; and 3) the recovery actions of the draft Least Bell's Vireo Recovery Plan (USFWS 1998), which recommends the restoration of potential or degraded habitat to support the recovery of this species.

Objective 1.2 - Restore Native Habitats in the Otay River Floodplain <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
		✓	✓	Seek funding by partnering with others to prepare construction-level restoration plans for the restoration of 145 acres in the Otay River floodplain.
		✓	✓	Establish partners and seek funding to implement the proposed restoration of the Otay River floodplain.
		✓	✓	Develop and implement a monitoring program to document natural recruitment of intertidal vegetation, <u>establishment of freshwater wetland habitats</u> , and fish and wildlife responses to restoration.

***Objective 1.3: Restore Tidal Wetlands at the Salt Works***

*When funding is identified, restore approximately 650 acres of salt ponds to tidal influence, providing a mix of habitat types that include shallow subtidal, intertidal mudflats, tidal channels and associated tidal flats, cordgrass-dominated salt marsh, and pickleweed-dominated salt marsh.*

**Rationale:** It is estimated that 88 percent of the historic salt marsh habitat and 92 percent of the original intertidal habitat (excluding salt marsh habitat) in San Diego Bay have been lost to dredging or filling (U.S. Navy 2000). Statewide, 80 percent of California's coastal wetlands have been converted to urban or agricultural use (USFWS 1999). This significant loss in coastal wetland habitat has led to a decline in several native species that are now federally-



listed as threatened or endangered. The loss of these wetlands also represents a significant loss in habitat for many species of migratory shorebirds (Hickey *et al.* 2003). The proposal to restore tidal wetlands is supported by the recovery actions recommended for the light-footed clapper rail, as well as the recommended actions included in Southern Pacific Shorebird Conservation Plan (Hickey *et al.* 2003).

Objective 1.3 - Restore Tidal Wetlands at the Salt Works				
<i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
		✓	✓	<u>Conduct project-level planning for the restoration of the salt works that involves 1) the completion of various baseline studies and other analyses, development of detailed restoration and engineering plans that are flexible enough to allow for changes based on monitoring results, 2) the preparation of appropriate environmental documentation, 3) public participation, and 4) the acquisition of all required permits and approvals.</u>
		✓		Establish partners and seek funding sources to restore a minimum of 200 acres and a maximum of 440 acres of intertidal wetlands within the salt works.
			✓	Establish partners and seek funding sources to restore approximately 650 acres of intertidal wetlands within the existing salt ponds.
		✓	✓	Develop and implement a monitoring program to document natural recruitment of intertidal vegetation and fish and wildlife response to restoration.
			✓	<u>Prepare and implement a restoration plan for the salt ponds that incorporates monitoring and an adaptive management approach to restoration.</u>
		✓	✓	<u>During and following restoration, maintain conditions within the salt pond system that support ground nesting seabirds and shorebirds, a brine invertebrate population, and nesting and foraging habitat for California least terns and western snowy plovers.</u>

**Objective 1.4: Reduce Human Disturbance**

*Within three years of CCP approval, implement new law enforcement activities on the Refuge that will reduce speeding on the open bay to no more than five violations per month, reduce illegal trespass on Refuge lands to not more than six contacts per month, and result in a 75% reduction in the number of vandalism incidents reported in FY 05.*

**Rationale:** Human presence on the water or along the shoreline can disturb roosting and foraging shorebirds and can cause nesting birds to temporarily abandon their nests. Various studies on the effects of wildlife disturbance have shown that general bird use decreases as frequency of disturbance increases (DeLong and Schmidt 2002). Disturbance compounds the effects of coastal wetland loss for birds and other wildlife that depend upon coastal wetlands for survival. Control of human disturbance is a recommended action of the light-footed clapper rail and California least tern recovery plans (USFWS 1985a, 1985c) and the Southern Pacific Shorebird Conservation Plan (Hickey *et al.* 2003).

Objective 1.4 - Reduce Human Disturbance <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
✓	✓	✓	✓	Coordinate with the U.S. Coast Guard and the Harbor Patrol to enforce the 5 mile per hour speed limit throughout the South Bay.
✓	✓	✓	✓	Continue weekly patrols to identify and remove illegal encampments in the Otay River floodplain, while also encouraging adjacent public landowners to control similar encampments on their properties.
✓	✓	✓	✓	Maintain communications between the Refuge law enforcement officer and other Refuge staff, and conduct monitoring to ensure rapid response to potential trespass/vandalism problems.
✓	✓	✓		Continue to prohibit salt works-related activity on the outer levees of the salt ponds from March 15 through September 15.
✓	✓	✓	✓	Limit all activities on the outer levees during the nesting season.
✓	✓		✓	Prohibit public access on the levees around Ponds 10 and 11.
		✓	✓	Immediately following the breaching of <u>any</u> of the western ponds, install fencing and/or other appropriate barriers around the <u>breached</u> pond(s) as needed to minimize disturbance to migratory <u>and resident</u> birds.
	✓	✓	✓	Secure a patrol boat / trailer to facilitate a law enforcement presence on the open waters of the Refuge within one year of CCP approval.
			✓	Within one month of the closure of the salt works, install fencing and signage to minimize unauthorized access into the salt pond complex.

***Objective 1.5: Identify and Remediate Environmental Contaminant Issues***

*Within three years of identifying a funding source, work with the Service's Division of Environmental Contaminants to develop and implement a baseline sampling plan for determining the extent and nature the Refuge's known or suspected containment areas, as identified in the CAP, and develop and implement a water quality monitoring program to characterize the quality of water entering the Refuge from upstream sources.*

**Rationale:** Understanding and addressing the threats that may exist to Refuge trust species due to the presence of environmental contaminants in the soil and water is an important part of protecting and managing Refuge habitats for the benefit of fish and wildlife. Various studies of San Diego Bay have documented the presence of constituents of concern within the water column, as well as within bay sediments. These and other contaminants may bioaccumulate in invertebrates, fish, and plants and eventually be transferred to avian and terrestrial species that feed on these organisms. In addition, initial contaminants assessments indicate the widespread presence of organochlorine pesticides and the presence of elevated levels of some metals within the Otay River floodplain. The initiation of baseline sampling is required to fully assess the potential threat to Refuge resources posed by these contaminants. Depending upon the results of baseline sampling, more detailed contaminants investigations and/or clean up or remediation efforts could be warranted.

Several surface water transport pathways are also present that could affect water quality within the Refuge. These include the Otay River, the drainage channels at Palomar Street and Main Street, Nestor Creek, and the drainage outfalls entering the Refuge from the City of Imperial Beach. Water quality monitoring is only occurring within a few of these drainages.

Objective 1.5 – Contaminant Issues <i>Comparison by Alternative</i>				
Alternative				Strategy
A	B	C	D	
	✓	✓	✓	Seek funding for, develop, and implement a baseline sampling plan based on the recommends included in the CAP.
		✓	✓	Once funding is identified, remove or otherwise remediate the soils within the Otay River floodplain containing elevated levels of organochlorine pesticides.
	✓	✓	✓	Seek funding to implement wet and dry weather water quality monitoring within the South San Diego Bay Unit. This monitoring effort should target surface water that is entering the Refuge via the Otay River, the Palomar and Main Street drainages, and Nestor Creek.

**Objective 1.6: Spill Contingency Plan**

*By FY 2008, develop a site-specific contingency plan for the Refuge that provides Refuge staff with guidance on the safe and effective response to a hazardous substance spill within or upstream of the Refuge and includes a public outreach component to inform the public, appropriate agencies, and upstream landowners and businesses of the notification procedures that should be taken if a spill occurs upstream of the Refuge.*

**Rationale:** The Refuge is located at the bottom of the watershed that supports a variety of commercial and industrial uses. Several potential transport pathways have been identified in the CAP that could provide a pathway for hazardous materials from an accidental spill to enter the Refuge's sensitive coastal wetlands. To ensure that safe and effective responses are implemented in a manner that best protect fish and wildlife resources and their habitats in the event of a spill, it is essential that a spill contingency plan be developed for the Refuge. Spills are more easily contained in early stages and near the source. A contingency plan would facilitate prompt notification of appropriate staff and provide for the effective execution of containment and cleanup measures.

Objective 1.6 – Spill Contingency Plan <i>Comparison by Alternative</i>				
Alternative				Strategy
A	B	C	D	
	✓	✓	✓	By FY 2008, complete a spill contingency plan for the Refuge and begin public outreach to ensure prompt notification in the event of a spill.
	✓	✓	✓	Once funding is identified, characterize the baseline contaminants conditions on the Refuge to document pre-spill conditions.

**Objective 1.7: Reduce the Accumulation of Fishing Line**

*Within three years of CCP approval, develop a Monofilament Recovery and Recycling Program (MRRP), modeled after the MRRP developed by the Florida Fish and Wildlife Conservation Commission, to educate the public about the problems caused by monofilament fishing line left in the environment, to encourage recycling of the line, to conduct volunteer monofilament line cleanup events, and to reduce the accumulation of fishing line, hooks, and other debris encountered in the South Bay by 90 percent over a two year period.*

**Rationale:** Discarded fishing line represents a serious threat to birds, particularly fish-eating birds. Entanglement with fishing line results in the death of many birds in South San Diego Bay, as documented by Refuge field staff. It is not unusual to observe up to several dead or dying birds entangled in one length of fishing line within the more dense nesting colonies on the salt pond levees. Species affected include the California brown pelican, California least tern, and many other species of terns and shorebirds. Other discarded materials, such as various forms of plastic, can result in injury or death for a variety of bird species and can also pose a threat to the bay's population of green sea turtles.

This problem can be reduced through the initiation of a public outreach program that would inform the public of the threat discarded fishing line poses for the Refuge's wildlife. Different audiences would be targeted through the use of a brochure aimed at the recreational fishing community and an annual clean-up event that would attract a larger segment of the community. Success would be monitored by surveying the shoreline and outer levees on a quarterly basis to determine if and to what extent the accumulation of fishing line and other debris has been reduced over previous years.

Objective 1.7 - Reduce the Accumulation of Fishing Line				
<i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
✓	✓	✓	✓	Continue to support the Port's efforts to inform the public about the impacts to wildlife of improperly disposing of fishing hooks and monofilament fishing line.
	✓	✓	✓	Expand the efforts initiated by the Port by developing a <u>MRRP modeled after the programs initiated in Florida. The program would include the development and distribution of a multi-lingual informational brochure aimed at both the recreational fishing community and the community at large that describes the threat to wildlife of improperly disposing of fishing line and other debris.</u>
	✓	✓	✓	In collaboration with State and local agencies and non-governmental organizations, sponsor an annual clean-up and public awareness event that focuses on fishing line clean-up activities throughout the bay.

**GOAL 2:**      **Support recovery and protection efforts for federally and state listed threatened and endangered species and species of concern that occur within the South San Diego Bay Unit.**

**Objective 2.1: California Least Tern Nesting**

*When funding is identified, increase the area of suitable nesting habitat for California least terns by creating at least 36 acres of nesting habitat within the salt pond complex consisting of several round or square areas greater than two acres in size capped with six to twelve inches of light sand and shell fragments. This new nesting habitat would be placed in proximity to productive foraging areas to support an average of one fledged chick per least tern nest over a fifteen year period, with at least 60 nests established annually following restoration.*

**Rationale:** California least terns historically nested along sandy beaches close to estuaries and embayments along the coast of California. However, human encroachment along the coast has severely diminished the availability of suitable nesting habitat. As a result, tern colonies are now restricted to small discrete areas of intensively managed habitat, as is the case on this

Refuge Unit. Least tern nesting at the salt works has been regular over many years, but not always successful. This is due primarily to mammalian and avian predation. Other factors that contribute to poor nesting success include human disturbance and inadequate nesting substrate. Increasing the acreage and quality of available nesting habitat would increase opportunities for least tern nesting, while also reducing crowding and conflicts with other birds that nest at the salt works.

Objective 2.1 - California Least Tern Nesting <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
✓	✓	✓	✓	Improve the nesting substrate on up to three acres of salt pond levees per a Cooperative Agreement with the Port by 2008.
✓	✓	✓	✓	Continue to conduct predator management around the salt ponds to improve nesting success for the California least tern.
✓	✓	✓	✓	Continue to monitor nesting season activity, fledgling productivity, and type and extent of predation at the salt works.
	✓	✓	✓	Enhance at least seven acres of levees by recontouring the tops and side slopes to achieve a maximum slope gradient of 4:1, and then cap the enhanced levees with six to twelve inches of light colored sand.
	✓	✓		Increase nesting opportunities by creating <u>at least 18 acres</u> of new nesting areas within the salt ponds and capping these areas with sand.
			✓	Increase nesting opportunities by creating <u>36 acres</u> of new nesting areas within the salt ponds and capping these areas with sand.
			✓	<u>Upon closure of the commercial salt operation, install additional fencing around the salt pond complex and across certain levees, as deemed appropriate, to minimize human disturbance and unauthorized access onto the salt pond levees.</u>

***Objective 2.2: California Least Tern Foraging***

*When funding is identified, restore at least 200 acres of existing salt pond habitat to tidal influence to increase foraging habitat for the California least tern.*

**Rationale:** The reproductive success of least terns is dependent not only on the availability of suitable undisturbed nesting sites, but also on the proximity of these nesting areas to waters with adequate supplies of appropriately sized foraging fish. Least terns generally prey on fish obtained from shallow estuaries and lagoons, although some colonies occasionally forage in the ocean (*USFWS 1985a*). When feeding itself, a least tern will typically travel farther and capture larger fish; however, when feeding newly hatched chicks, the tern must capture very small fish and make frequent trips to nearby shallows (Massey 1988, Cimberg and Dock 1988, Keane 1996). The reintroduction of tidal influence into portions of the salt ponds would provide additional habitat for fish, particularly smaller fish, in proximity to existing and potentially new least tern nesting areas. Enhancing foraging opportunities in proximity to nesting areas is expected to support increased least tern reproductive success within the Refuge Unit.

Objective 2.2 - California Least Tern Foraging <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
✓	✓			Restore tidal influence in Pond 28 or 29 to create additional foraging habitat for the least tern by 2008.
		✓		Restore a minimum of 200 acres and a maximum of 440 acres of intertidal wetlands within the salt ponds.
			✓	Restore approximately 650 acres of intertidal wetlands within the existing salt ponds.

***Objective 2.3: Light-footed Clapper Rail***

*Within five years of initial restoration, achieve 50 percent coverage of cordgrass over approximately 470 acres within the South San Diego Bay Unit. The height of 25 percent of the plants should be in excess of 60 centimeters (cm) and of this, at least 10 percent reaching >90 cm in height. The ultimate goal is to achieve a density of at least 100 stems per square meter (m<sup>2</sup>) with at least 90 stems/m<sup>2</sup> reaching a height in excess of 60 centimeters (cm) and of this, at least 30 stems/m<sup>2</sup> reaching >90 cm in height (Zedler 1993) over a minimum of 300 acres within ten years of initial restoration.*

**Rationale:** The substantial loss of wetlands along the California coast is the primary cause for the drastic decline in the light-footed clapper rail population, although other factors such as predation by raptors and mammals have also contributed to this decline. The prime objective of the Recovery Plan for the clapper rail is to increase the breeding population of this species by preserving, restoring, and/or creating adequately protected, suitably managed wetland habitat consisting of at least 50 percent marsh vegetation (*USFWS 1985c*). Implementation of the CCP would support the Recovery Plan's primary objective.

Objective 2.3 - Light-footed Clapper Rail <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
✓	✓	✓	✓	Continue to conduct predator management to reduce the loss of light-footed clapper rail adults, chicks, and eggs to avian and mammalian predators.
		✓	✓	Develop restoration plans for the salt ponds and Otay River floodplain that take into consideration the habitat needs of the clapper rail. These plans should ensure adequate areas of cordgrass habitat, as well as areas of isolated hummocks or small berms to support upper-marsh vegetation needed to provide the rails with shelter during extreme high tides.
		✓		Restore a minimum of 180 acres of cordgrass-dominated salt marsh within the Otay River floodplain and salt ponds.
			✓	Restore a minimum of 470 acres of cordgrass-dominated salt marsh within the Otay River floodplain and salt ponds.
		✓	✓	Following restoration, annually monitor the restored areas to determine the status, breeding locations, and habitat utilization patterns of the Refuge's light-footed clapper rail population.



**Objective 2.4: Western Snowy Plover**

*Once restoration of the salt ponds begins, seasonally regulate the water level in one of the ponds proposed for water management to provide a minimum of 25 acres of dry salt flats capable of supporting within five years of restoration 20 snowy plover nests per season with an average of at least one fledged chick per male snowy plover over a 15-year period.*

**Rationale:** Human disturbance, predation, and inclement weather, combined with permanent or long-term loss of nesting habitat, have led to the decline in active nesting colonies, as well as an overall decline in the breeding and wintering population of western snowy plovers along the Pacific coast. The greatest losses of habitat to support this species have occurred in southern California, where breeding western snowy plovers have been extirpated from parts of San Diego, Ventura, and Santa Barbara counties, most of Orange County, and all of Los Angeles County. Providing nesting habitat suitable for plover nesting within the salt works would support current recovery efforts for the species.

Objective 2.4 - Western Snowy Plover <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
✓	✓	✓	✓	Continue to monitor snowy plover nesting activity, fledging productivity, and type and extent of predation at the salt works.
✓	✓	✓	✓	Continue to conduct predator management within the salt works to improve nesting success for the western snowy plover.
	✓	✓	✓	Develop and implement a plan to regulate water levels in <u>one of the managed ponds</u> to provide a minimum of 25 acres of dry salt flats within the pond.
		✓		<u>In addition to providing 25 acres of dry salt flats, create at least 18 acres of new nesting habitat within the salt pond complex</u>
			✓	<u>In addition to providing 25 acres of dry salt flats, create 36 acres of new nesting habitat within the salt pond complex.</u>
	✓	✓	✓	<u>Use fencing and exclosures to protect snowy plover chicks and eggs from predation and close the salt pond levees to all activity except monitoring and predator management during the nesting season.</u>

**Objective 2.5: California Brown Pelican**

*Maintain and protect appropriate pelican roosting habitat within the South San Diego Bay Unit and implement management actions to maintain or expand current numbers of roosting brown pelicans at this site.*

**Rationale:** The availability and quality of roosting and loafing areas plays an important role in the energy budgets and reproductive potential of brown pelicans (Jaques and Anderson 1987). The availability of such areas has decreased in California due to continuing development along the coastline. Currently, the western pond levees, particularly the levee located between Ponds 10 and 11, provide important roosting habitat for this species. These areas are most frequently used between the months of June through December; however, the south bay is also an important roosting and foraging area for non-breeding pelicans throughout the year. Protecting roosting areas within the South San Diego Bay Unit would assist in implementing the primary objective of the California Brown Pelican Recovery Plan (USFWS 1983).

Objective 2.5 – California Brown Pelican <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	
✓	✓			<u>Continue current management within the salt pond complex and monitor the use of the pelican platform installed in the eastern primary ponds.</u>
		✓	✓	<u>Maintain appropriate pelican roosting habitat along the salt pond levees and on the pelican platform, monitor population levels during and after restoration, and implement management actions to reduce disturbance and encourage continued pelican roosting within the area.</u>

**GOAL 3:** Provide high quality foraging, resting, and breeding habitat for colonial nesting seabirds, migratory shorebirds and waterfowl, and salt marsh-dependent species.

***Objective 3.1: Colonial Nesting Seabirds***

*When funding is available, increase the quality of nesting habitat available for colonial seabirds to maintain species diversity and reduce crowding. Accomplish this by enhancing at least ten acres of the existing levee system (through levee widening, recontouring of levee slopes, and capping the improved levees with six to 12 inches of sand) and by creating a minimum of 36 acres of new nesting habitat within the salt pond complex.*

**Rationale:** Many colonial nesting waterbirds face threats to the stability of their populations due to degradation of coastal and marine habitats, depletion of the forage base, and contaminants. Since 1985, six species of colonial waterbirds have established nests at the salt works. Three of these species, the gull-billed tern, elegant tern, and black skimmer, are included on the Service's list of Birds of Conservation Concern (USFWS 2002). Enhancing nesting opportunities and managing the site to reduce threats to nesting success will encourage the continued use of the salt pond levees as nesting habitat for these species.

Objective 3.1 - Colonial Nesting Seabirds <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	
	✓	✓	✓	<u>Enhance the existing substrate on a minimum of 10 acres of levee area around the salt ponds by adding six to twelve inches of light colored sand to improve nesting conditions for ground nesting seabirds.</u>
	✓	✓	✓	Inspect nesting areas annually to determine if maintenance is required to ensure the availability of quality nesting habitat.
	✓	✓	✓	Install temporary fencing across levees to minimize access to nesting areas where mammalian predation is identified as a problem.
	✓	✓	✓	Remove debris and miscellaneous structures that could serve as an avian predator perch, and eliminate potential access routes that provide mammalian predators with easy access into the colony.
		✓	✓	Install new fencing and regulatory signage to minimize disturbance in the nesting colonies and periodically remove vegetative cover on <u>and adjacent to the levees</u> to maintain open views for the nesting seabirds.

Objective 3.1 - Colonial Nesting Seabirds (Continued)				
Alternative				Strategy
A	B	C	D	
		✓	✓	Monitor nesting activity on the levees to determine the effects, if any, of restoration on nesting seabirds. If after considering the results of the monitoring data from this and other seabird nesting areas, it is determined that restoration is resulting in reductions in the diversity and/or density of seabird nesting on the levees, specific management actions, such as intensifying predator management, reducing human disturbance, and/or restoring an open water component around some of the levees would be taken.

**Objective 3.2: Brine Invertebrates**

*Over the life of the CCP, maintain a stable source of brine invertebrates as forage for breeding, migrating, and wintering birds by managing approximately 44 acres of salt ponds at salinity levels ranging from 80 to 120 ppt.*

**Rationale:** Although no formal studies of the foraging habits of the birds that frequent the salt ponds have been conducted to date, anecdotal observations of avian activity and the results of studies from other similar environments, such as Mono Lake, indicate that the brine invertebrates produced in the salt ponds provide important forage for an number of avian species, including phalaropes and grebes. Brine invertebrates produced in the salt ponds likely provide an important resource for some birds migrating along the Pacific Flyway; consequently, the Refuge would continue to maintain a viable brine invertebrate population whether or not salt production continues at this site.

Objective 3.2 - Brine Invertebrates Comparison by Alternative				
Alternative				Strategy
A	B	C	D	
✓				Provide a source of brine invertebrates by continuing the current solar salt operation.
	✓	✓		Continue to provide conditions favorable to brine invertebrates within the reduced solar salt operation.
			✓	Develop a water management plan that includes hypersaline ponds to support brine invertebrates in the absence of salt production.
	✓	✓	✓	Improve shorebird access to brine invertebrates by <u>increasing the area available for foraging within the salt pond complex</u> . This could be achieved by reducing water levels in some ponds during migration and recontouring the levee edges to reduce steep slopes and increase the available shoreline.

**Objective 3.3: Shorebirds**

*Manage the South San Diego Bay Unit in a manner that would continue to support significant numbers of shorebirds (approximately 70 percent of all birds observed on the South San Diego Bay Unit within a given year) prior to, during, and after proposed enhancement and restoration actions.*

**Rationale:** Shorebirds represent a significant proportion of bird use within this Refuge Unit during the nonbreeding period. Many of these shorebirds are identified as either Birds of Conservation Concern (USFWS 2002b) or considered highly imperiled or of high conservation concern by the U.S. Shorebird Conservation Plan (2004). Because available habitat for these birds is limited within San Diego Bay, emphasis should be placed on protecting and enhancing the existing habitat for these species within the South San Diego Bay Unit.

Objective 3.3 - Shorebirds <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
	✓	✓	✓	Conduct an updated year-long bird survey similar to that conducted in 1993 and 1994 to establish a baseline for comparing current and future conditions at the site.
	✓	✓	✓	Monitor shorebird use within the Refuge Unit throughout the implementation phase of the CCP to record use patterns, species diversity and abundance, and observed responses to restoration. Consider the results of this monitoring in future restoration phases.
	✓	✓	✓	Minimize disturbance to shorebird foraging, loafing, and nesting habitat during the implementation of CCP.
		✓	✓	Maintain communication with other entities involved in salt pond restoration during the development and implementation of detailed restoration plans to learn from their research and observations.
		✓	✓	Consider the nesting requirements of black-necked stilts, American avocets ( <i>Recurvirostra Americana</i> ), and killdeer ( <i>Charadrius vociferous</i> ) during detailed restoration planning for the salt ponds.

***Objective 3.4: Minimize Disturbance to Wintering Birds***

*Within three years of CCP approval, reduce disturbance to rafting brants, scoters, and other wintering waterfowl and to shorebirds foraging along the Refuge's intertidal mudflats by reducing the number of boats exceeding the 5 mph speed limit in the South Bay to less than five per month.*

**Rationale:** Shorebirds rely on intertidal habitat for feeding, roosting, and resting. Unfortunately, the loss of intertidal habitat has been the most severe among the habitats lost to development within the bay (U.S. Navy 2000). Of the 976 acres of intertidal habitat that remain in San Diego Bay, the majority occurs in the South Bay. As a result, large concentrations of shorebirds can be observed in these areas during the winter months. Between 1993 and 1994, the Service made 50,000 bird observations, primarily shorebirds and seabirds, on the intertidal mudflats to the north of the salt ponds (USFWS 1994). Equally important to wintering birds, such as black brant and surf scoter (*Melanitta perspicillata*), is the South Bay's shallow subtidal habitat.

Because this important migratory and wintering bird habitat is concentrated in one general location, it is critical to properly manage human activities within this area to minimize disturbance. Migratory and wintering birds generally attempt to minimize time spent in flight and maximize time for feeding. Flight requires considerably energy. Studies undertaken to evaluate the effects of boating and other human activities on migrating and wintering birds have concluded that continued disturbance poses a serious threat to the continued use of an area by avian species (DeLong and Schmidt 2002). Human disturbance can result in changes

in feeding habits and locations, feeding only at night, loss of weight, and/or complete abandonment of a feeding area (*Korschgen and Dahlgren 1992*). It is essential to properly protect this habitat in order to preserve its value for migratory and wintering birds.

Objective 3.4 - Minimize Disturbance to Wintering Birds <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
✓	✓	✓	✓	Continue to patrol activities around the salt works from the pond levees using law enforcement staff and biological monitors.
	✓	✓	✓	Acquire a patrol boat and dedicate law enforcement staff to patrol the open waters of the Refuge at least twice a month during the winter months to enforce the 5 mph speed limit within Refuge waters.
	✓	✓	✓	Delineate the boundaries of the Refuge using signs and buoy markers within the open bay by 2008. Incorporate informational signage <u>on these markers that explains why boaters should</u> adhere to the 5 mph speed limit and encourages boaters to maintain appropriate distances from the shoreline and exposed mudflats.
	✓	✓	✓	<u>Partner with other agencies, such as the Port and the cities of Chula Vista, Coronado, and National City to inform boaters and others about the importance of protecting the resources within the Refuge. This could involve placing signs at marinas, boat launch facilities, and fishing piers, conducting interpretive programs, and providing interpretive displays in various locations around the south bay.</u>
	✓	✓	✓	Using the results of monitoring activities conducted within the Refuge, evaluate the effectiveness of current signage, as well as enforcement actions, to control and ultimately eliminate unauthorized activities in proximity to the Refuge's intertidal mudflat and salt marsh habitat.

**GOAL 4:**      **Provide opportunities for compatible wildlife-dependent recreation and interpretation that foster public appreciation of the unique natural and cultural heritage of South San Diego Bay.**

***Objective 4.1: Wildlife Observation and Photography***

*When funding is available, create four observation sites around the perimeter of the Refuge and provide some limited access into the restored salt ponds through guided nature tours and a 1.5-mile interpretive trail around Pond 28. The intent is to provide opportunities for the public to observe the sights and sounds of the Refuge without compromising the feeling of isolation that the salt ponds provide for the tens of thousands of birds that utilized the area each year.*

**Rationale:** Very few opportunities for wildlife observation and photography exist on the Refuge today. Expanding these opportunities would allow visitors to experience the variety of avian species that utilize the salt ponds and the open waters of the bay throughout the year. Wildlife observation and photography are two of the six priority public uses of the NWRs; when provided, these uses serve to promote a broader public understanding of the value of natural resources and the need to conserve these resources. Every effort should be made to facilitate opportunities for wildlife observation and photography when they can be provided without compromising wildlife and habitat values.

Objective 4.1 - Wildlife Observation and Photography <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
✓	✓			Maintain the current opportunities for wildlife observation and photography.
		✓		Expand opportunities for wildlife observation and photography by opening the northern levee of Pond 11 to public access.
		✓	✓	Construct a <u>pedestrian pathway</u> along the Bayshore Bikeway from 7 <sup>th</sup> Street to 10 <sup>th</sup> Street <u>and Florida Street to 13<sup>th</sup> Street</u> in Imperial Beach.
		✓	✓	Increase the number of guided nature tours provided at the salt works to two per month outside of the nesting season.
			✓	Establish observation points <u>along the proposed pedestrian pathway</u> (near the terminus of 7 <sup>th</sup> Street, 8 <sup>th</sup> Street, 10 <sup>th</sup> Street, and 12 <sup>th</sup> Street in Imperial Beach and along the eastern edge of Pond 29 in Chula Vista) around the perimeter of the Refuge.
			✓	Following closure of the salt works, construct a 1.5-mile nature trail around Pond 28.

**Objective 4.2: Environmental Interpretation**

*Within five years of the CCP's approval, prepare a step-down interpretive plan that includes five interpretative areas along the perimeter of the Refuge where the need for habitat conservation and restoration and the role this Refuge plays in avian migration will be interpreted. A minimum of 20 percent of the interpretive elements proposed in the plan should be directed at new or non-traditional visitors. Prior to closing the salt works, develop a program to interpret the historical significance of solar salt production in San Diego Bay.*

**Rationale:** Environmental interpretation is a use identified in the NWRS Improvement Act of 1997 as one of the six priority public uses of the NWRS. It provides an important tool for increasing public awareness of the importance of the Refuge's many resources, while also building public understanding and support for the need to limit public access in some portions of the Refuge.

Objective 4.2 - Environmental Interpretation <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
		✓	✓	Partner with other agencies to incorporate topics related to Refuge resources in other interpretive programs around San Diego Bay.
			✓	Prepare and implement an interpretive plan for three observation areas along the Bayshore Bikeway (at 13th, 10th, and 8th Streets).
			✓	Develop an interpretative path at the 10 <sup>th</sup> Street site that addresses environmental education and habitat restoration.
			✓	Develop a program to interpret historic hunting activities on the South Bay and hunting within the NWRS.
			✓	Develop an interpretive program to address the historic significance of the salt works to the solar salt industry and the region.
			✓	Develop interpretive materials for the Pond 28 trail.

**Objective 4.3: Environmental Education**

*Continue to seek partners to provide funding, volunteer support, and students for the Habitat Heroes environmental education program conducted on the Refuge to serve approximately 500 second grade through junior college students annually.*

**Rationale:** Many opportunities exist to work together with partners to develop environmental education programs. The Refuge staff, in partnership with others, has successfully developed such programs at the Sweetwater Marsh and South San Diego Bay Units. These programs, including Sweetwater Safari and Habitat Heroes, have been well received by the educational community. The Habitat Heroes program has focused on the serving the communities of Imperial Beach and Otay-Nestor, but could be expanded to reach a larger audience in the South Bay if additional funding is identified. The San Diego NWR Complex has and will continue to participate on a regional level in coordinating and encouraging these types of environmental education efforts as they are essential to implementing the purposes of the Refuge and the mission of the NWRS.

Objective 4.3 - Environmental Education <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
			✓	Seek funding partners to establish the Habitat Heroes program as a permanent environmental education program for the Refuge.
			✓	Participate in ongoing discussions with other local agencies and organizations regarding the creation of an interagency Environmental Education Facilitator for the South Bay.

**Objective 4.4: Fishing and Boating**

*Maintain the current level of recreational boating and fishing opportunities occurring in the open water portions of the South San Diego Bay Unit.*

**Rationale:** Recreational boating and fishing are permitted uses throughout most of San Diego Bay, including the open waters of the South San Diego Bay Unit. Fishing is one of the six priority public uses of the NWRS that are to receive priority consideration in Refuge planning. Boating, although not a priority public use, can provide opportunities for other priority uses including fishing, wildlife observation, photography, and environmental interpretation. Refuge resources can be protected, while also providing opportunities for boating and fishing.

Objective 4.4 - Fishing and Boating <i>Comparison by Alternative</i>				
<i>Alternative</i>				<i>Strategy</i>
A	B	C	D	
✓	✓	✓	✓	Continue to allow fishing in the open bay portion of the Refuge per State regulations.
		✓		Expand recreational fishing opportunities in the Refuge to include fishing from the northern levee of Pond 11.
✓	✓	✓	✓	Continue to allow recreational boating in the open bay portion of the Refuge in accordance with the requirement that all water vessels maintain a speed of five miles per hour.



**Objective 4.5: Cultural Resource Program**

*Implement a proactive cultural resource management program that focuses on meeting the requirements of the National Historic Preservation Act, including consultation, identification, inventory, evaluation, and protection of cultural resources.*

**Rationale:** It is the policy of the Service to identify, protect, and manage cultural resources located on Service lands and affected by Service undertakings, in a spirit of stewardship, for future generations. Cultural resources that occur within the boundary of this Refuge Unit provide important opportunities for interpretation and education for a diverse audience and therefore warrant the development of a comprehensive cultural resource management program for the Refuge Unit.

Objective 4.5 - Cultural Resource Program				
Comparison by Alternative				
Alternative				Strategy
A	B	C	D	
✓	✓	✓	✓	Conduct a cultural resource survey of the Otay River floodplain according to the regulations of the NHPA and test all sites that have not yet been evaluated for eligibility to the NRHP.
✓	✓	✓	✓	Create and utilize a Memorandum of Understanding with Native American groups to implement the inadvertent discovery clause of the Native American Graves Protection and Repatriation Act (NAGPRA).
	✓	✓	✓	Assess the effects of enhancement and restoration activities on the use, design, and function of the salt works according to the regulations of the NHPA.
		✓	✓	Develop a treatment plan to address adverse effects to the South Bay Salt Works. Stipulate the implementation of the treatment plan in a Memorandum of Agreement (MOA) with SHPO and the Advisory Council on Historic Preservation and consult with interested parties.
		✓	✓	Develop an interpretive program that presents accurate information about Native American history within the South Bay.

# *Chapter 3 – Affected Environment*

## **3.1 Introduction**

This chapter describes the environment that may be affected by the various management actions presented in Chapter 2 for the Sweetwater Marsh and South San Diego Bay Units of the San Diego Bay NWR. The affected environment includes important habitats and resources within and around the southern end of San Diego Bay and the westernmost reaches of the Otay and Sweetwater Rivers. The project study area (Area of Potential Effect) is depicted Figure 3-1. The Sweetwater Marsh Unit is made up of five distinct areas, including the F&G Street Marsh, Sweetwater Marsh, Gunpowder Point, D Street Fill, and Paradise Marsh (refer to Figure 1-3). The South San Diego Bay Unit includes three distinct areas; the Otay River floodplain, the salt ponds, and the open bay (refer to Figure 1-4).

## **3.2 Regional and Historic Setting**

The Sweetwater Marsh and South San Diego Bay Units encompass approximately 2,620 acres of land and water located in the southern portion of San Diego Bay in San Diego County, California. The lands and waters included within the San Diego Bay Refuge abut the urbanized communities of National City, Chula Vista, San Diego, Imperial Beach, and Coronado. Refuge habitats offer resting, foraging, and nesting areas for an abundant and diverse assemblage of birds, as well as habitats that support a variety of fish and marine and terrestrial invertebrates, and a smaller array of amphibians, reptiles, and mammals.

Approximately 2,100 acres of open water within San Diego Bay are included within the acquisition boundary of the South San Diego Bay Unit. Of that total, approximately 1,000 acres are currently managed as a NWR (refer to Figure 1-5). San Diego Bay is a natural, nearly enclosed crescent-shaped embayment that originated from alluvial plains of the Otay, Sweetwater, and San Diego Rivers. The bay has a water surface area of approximately 17 square miles at mean lower low water (MLLW) and a total length of approximately 15 miles (*SDUPD 1990*).

San Diego Bay is located within an area referred to as the Southern California Bight, a curve in the southwestern California coastline that extends from Point Conception to just south of the Mexican border. The marine ecosystem and overall biodiversity within the Southern California Bight are influenced by the dramatic change in the angle of the coastline, which creates a significant backwater eddy. This backwater eddy results in the northern flow of equatorial waters along the nearshore and the southern flow of subarctic waters offshore. The biological transition zone that occurs between these warm and cold waters supports approximately 500 marine fish species and more than 5,000 invertebrate species (*Southern California Coastal Water Research Project 1998*).

San Diego Bay receives minimal freshwater input and has a high evaporation rate. Freshwater contributions come primarily from the Otay and Sweetwater Rivers, with some minor input provided by several small creeks. Historically, the bay floor and margins were characterized by sand, silt, clay, mud, and mudstone. Today, sand particles dominate the sediments at the mouth of the bay, while finer mud and silt deposits occur in the South Bay.

An 1859 survey map of San Diego Bay (Figure 3-2) indicates that prior to human disturbance, the South Bay consisted of coastal salt marsh, intertidal mudflats, and shallow subtidal (less than 12

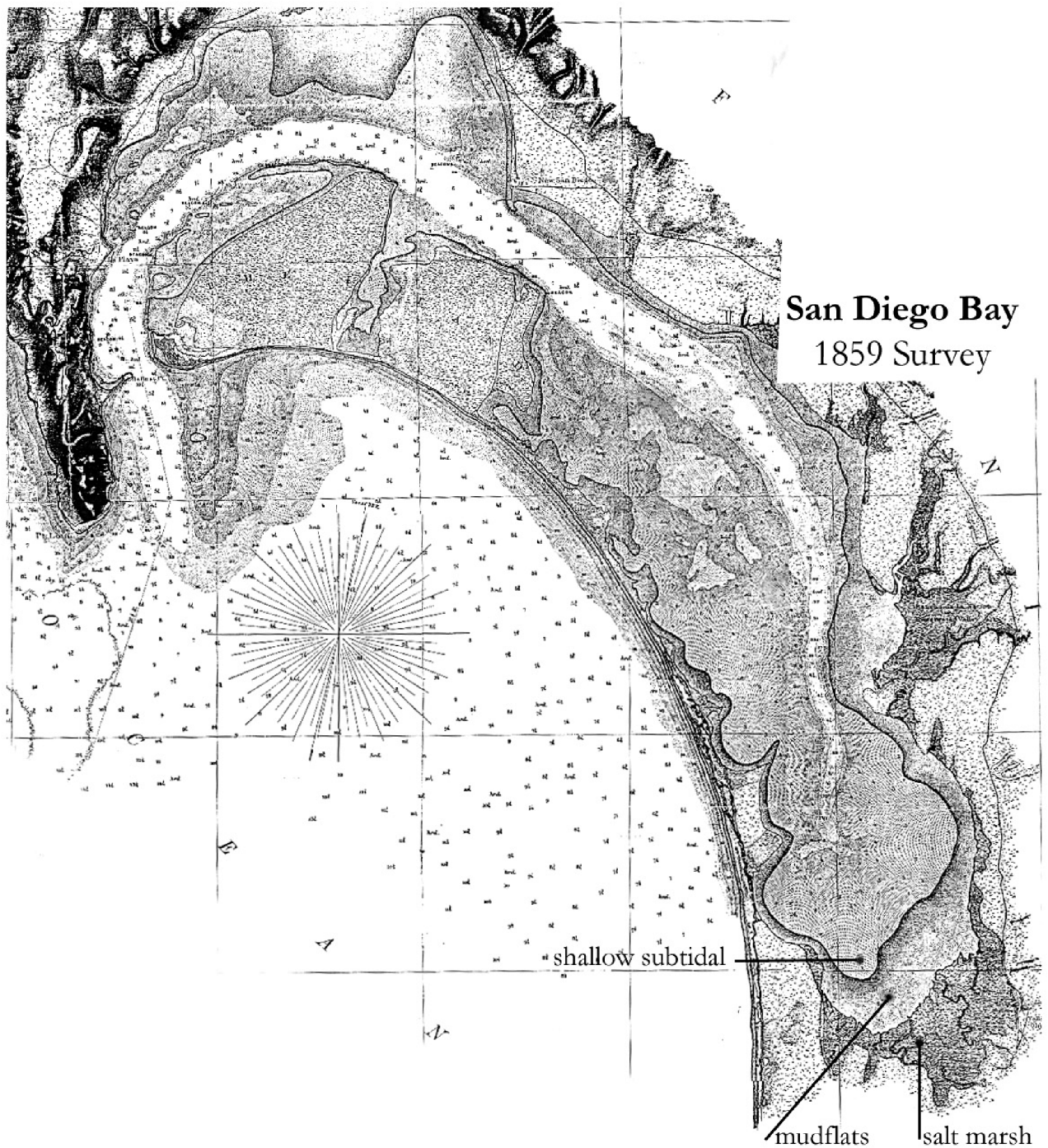


**Figure 3-1d**  
**San Diego Bay NWR Comprehensive Conservation Plan d**  
**Project Study Area (Area of Potential Effects)d**

Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)

Carlsbad Field Office - 2003C  
 /stem/stacey/ssdbay/fig\_4-03/figures.aprC





**Figure 3-2**  
**Historical Condition of San Diego Bay (1859)**

Source: Survey of the Coast of the United States, Coastal Survey Office, 1859.



No scale.

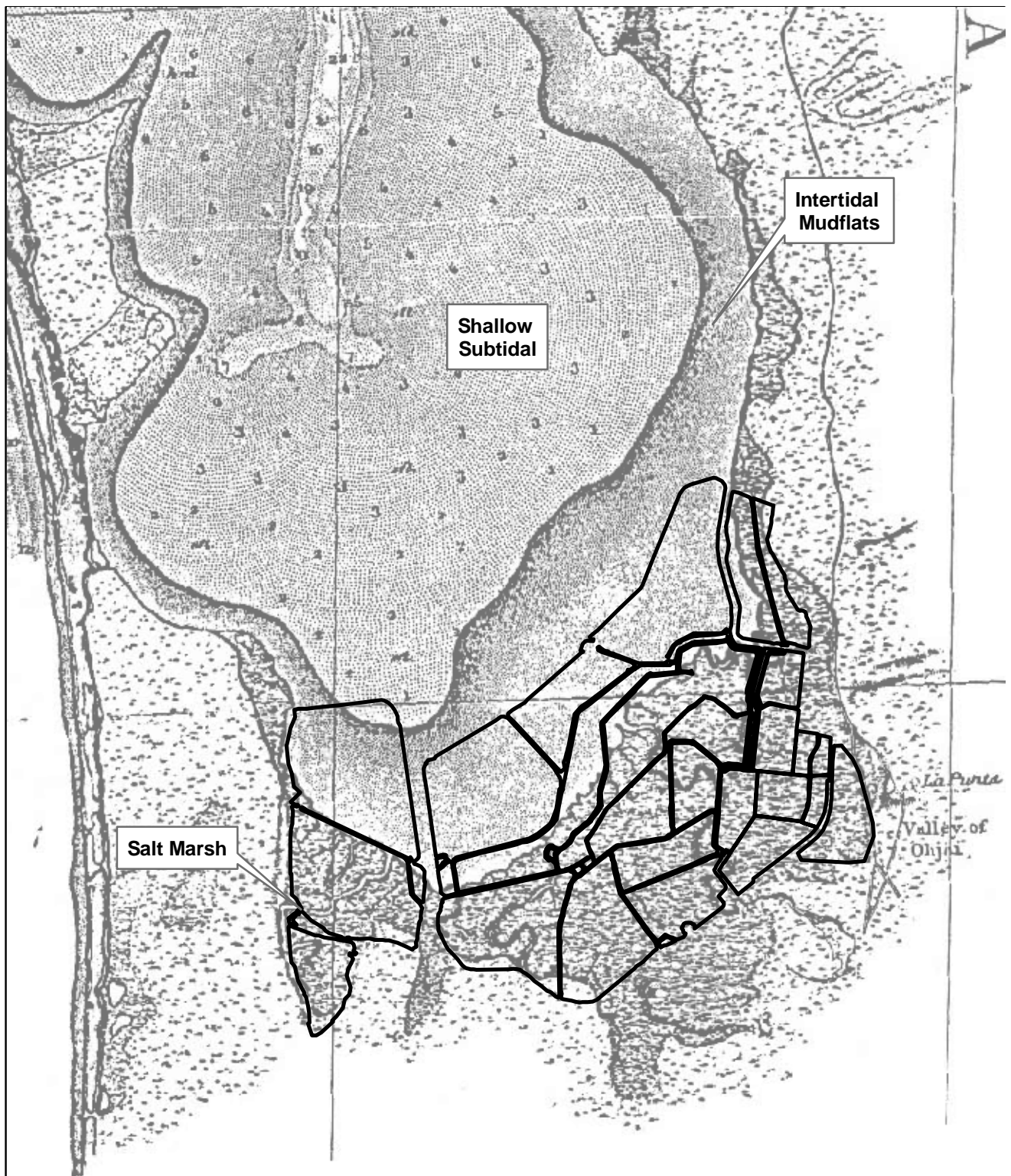
feet in depth) habitats. A deep narrow channel extended from the mouth of the bay to about the southern end of what is now the Sweetwater Marsh Unit. This channel is considerably deeper and wider today, as a result of years of dredging to accommodate military and commercial ship passage. A significant portion of the upper and central bay has been dredged to accommodate various port activities, with much of the dredge material used to fill in the adjacent tidelands.

Unlike the northern and central portions of the bay, the South Bay has experienced only limited dredging and filling activity. Those areas that have been filled include the area now occupied by the Chula Vista Wildlife Reserve and the industrial areas to the north and east of the Chula Vista marinas (refer to Figure 1-6). Dredging has occurred on the east and west sides of the South Bay to create channels deep enough to accommodate boat passage from the main part of the bay into the Coronado Cays and the Chula Vista Marina. Another remnant channel was also created in Emory Cove.

A significant area of historic coastal salt marsh habitat is protected along the eastern edge of the south bay within the Sweetwater Marsh Unit of the San Diego Bay NWR Refuge. This habitat supports a variety of migratory shorebirds and wintering waterfowl, as well as the endangered light-footed clapper rail, a year-round resident of the marsh. Although the upland areas on this Unit have experienced extensive human disturbance, today, portions of these uplands provide important habitat for ground nesting birds. Other upland areas provide opportunities to restore native upland and wetland habitats that historically occurred here. The Sweetwater Marsh Unit provides habitat for two federally endangered bird species, the California least tern and light-footed clapper rail, one threatened species of bird, the western snowy plover, and one endangered plant species, salt marsh bird's beak. The American Bird Conservancy has designated this Refuge Unit as a Globally Important Bird Area.

The most significant change to the natural environment within the southern end of the bay can be attributed to the creation of solar salt evaporation ponds, which are still used today to produce salt. At its peak, the salt works occupied an area of approximately 1,300 acres. Today, the salt works occupies approximately 1,060 acres. Figure 3-3 illustrates the natural condition of the bay in 1859 and the extent of salt marsh habitat that has been lost to the creation of the salt works and other uses over the last 140 years. The salt pond complex, which consists of diked open water cells with differing levels of salinity, provides roosting habitat for a variety of migratory birds during high tide, supplemental foraging habitat for various shorebirds, and primary foraging habitat for other species such as phalaropes and eared grebes. The salt pond levees also provide nesting habitat for a variety of ground nesting birds, including the endangered California least tern, the threatened western snowy plover, and an array of other tern species, some of which only nest in a few locations in the United States. The American Bird Conservancy has designated the South San Diego Bay Unit as a Globally Important Bird Area due to the presence of globally significant numbers of nesting gull-billed terns and continentally significant numbers of surf scoters, Caspian terns, and western snowy plovers. The entire southern end of San Diego Bay, including the Sweetwater Marsh and South San Diego Bay Units, has also been recognized as a Western Hemisphere Shorebird Reserve Network Site.

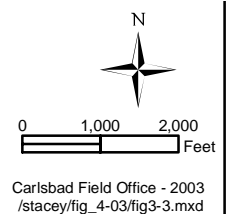
Very little natural habitat remains on the upland areas adjacent to the bay, and only scattered remnants of the coastal estuaries that once occupied the lower reaches of the Sweetwater and Otay Rivers have been preserved. The majority of this remaining natural habitat within the south bay is protected within the boundaries of the San Diego Bay NWR. Opportunities to restore native uplands and important wetland/upland transition areas are available on both the Sweetwater Marsh and South San Diego Bay Units.



**Figure 3-3**  
**Comparison of Historic and Existing Conditions in the South Bay**

 Salt ponds

Sources: Survey of the Coast of the United States, Coastal Survey Office, 1859; USFWS





### **3.3 Physical Environment**

Elements of the physical environment include climate, geology, soils, agricultural resources, topography/visual quality, hydrology/water quality, contaminants and noise.

#### **3.3.1 Climate**

Coastal San Diego County's mild, year-round climate is characterized as subtropical Mediterranean, with dry, warm summers and wet, cool winters. The average annual temperature is 60.4 °F, with an average high temperature of 67.3 ° F and an average low temperature of 53.4 ° F (*USFWS 1991*).

Along the coast, fog is common in the summer and seasonal rainfall averages 10 inches (25.4 centimeters) between November and March. Upstream in the coastal drainages the mean annual precipitation is closer to 19 inches (48.26 centimeters). Annual precipitation is extremely variable in this region. For example, over the past century annual precipitation has ranged from 3.02 inches (7.67 centimeters) to 26 inches (66.04 centimeters) at the San Diego gauge (*City of San Diego 2001*). The 3.02 inches of rainfall received in San Diego between July 1, 2001 and June 30, 2002 represents the driest year on record (*NOAA 2002*).

Winds over the bay are usually breezy (about 10 knots), although the area also experiences stronger seasonal and diurnal winds. During much of the year, westerly winds increase in the afternoon as cool air moves inland. Calmer evening and early morning easterly winds are common in the winter. Stronger winds, associated with cold fronts moving through the region, are also likely at times during the winter months. Easterly Santa Ana winds may be quite strong in the fall, driven by high pressure over inland deserts. Winds are generally greater south of the Coronado Bridge than north of it, with the greatest wind speeds in the central South Bay, west of the Sweetwater Channel (*U.S. Navy 2001*). Prevailing winds in the vicinity of the salt ponds are from the northwest.

#### **3.3.2 Topography/Visual Quality**

##### **3.3.2.1 Sweetwater Marsh Unit**

The wetlands and uplands of the Sweetwater Marsh Unit occur on a gentle westerly-sloping wave-cut abrasion terrace. The overall inclination is about 1 foot per 100 feet (*Keller 1991*). Gunpowder Point, situated just a few feet higher than the surrounding marsh at about 10 feet Mean Sea Level (MSL), is the most prominent natural upland area within the Unit. This area consists of exposed Bay Point Formation. The flat, manmade uplands that form the D Street Fill are also situated at about 10 feet MSL. Paradise Marsh, located to the north of the main Refuge area, is confined by a Bay Point Formation terrace, which forms the natural bluffs along the northwest margin of the marsh. Exposed Bay Point Formation also isolates the F&G Street Marsh from the other wetland areas within the Refuge. This marsh occurs within a broad, drainage that flows southward to the bay.

The lack of significant topographic relief across the Refuge facilitates broad views of the Refuge from I-5, portions of E Street in Chula Vista, Pepper Park in National City, and from across the bay along the Silver Strand. The most prominent visual features on the site as viewed from outside the Refuge include the Chula Vista Nature Center, the Refuge office, interpretive elements along the public trail system, and a few non-native trees planted prior to the establishment of the Sweetwater Marsh Unit.



### **3.3.2.2 South San Diego Bay Unit**

The predominant topographic features of this open water dominated Refuge Unit include the levee system within the salt works, the Chula Vista Wildlife Reserve, and the uplands of the Otay River floodplain. Portions of the Chula Vista Wildlife Reserve extend above the highest high tide levels and are visible from the public areas around the Chula Vista Marina, the north end of salt ponds, and from across the bay along the Silver Strand. The levees that form the salt ponds at the south end of the bay are visible from the bay and much of the developed upland areas that border the bay to the south. The relatively flat Otay River floodplain gently slopes from southeast to northwest, with elevations ranging from about 18.5 feet to 9.5 feet above MSL.

### **3.3.3 Geology and Soils**

#### **3.3.3.1 Sweetwater Marsh Unit**

Geologically, the Sweetwater Marsh Unit is situated on the westerly-sloping Nestor Terrace, one of a series of well-defined wave-cut abrasion terraces created during the Pleistocene glacial episodes (*Keller 1991*). This Unit is underlain by the Bay Point Formation, which dates to approximately 120,000 years. This geologic formation is exposed on Gunpowder Point. Overall, Gunpowder Point consists of a combination of Bay Point Formation and unnamed, nearshore, marine sandstone (*Kennedy and Tan 1977*). The lower portions of the Refuge Unit, particularly the wetland areas, consist of undifferentiated alluvium and slope wash.

The predominant soils within the coastal wetland areas of the Sweetwater Marsh Unit are identified as tidal flats, while the upland areas on Gunpowder Point are overlain by Huerhuero loam (*USDA 1973*). The constituents of tidal flats can range from clays to very fine sands. Huerhuero loam consists of sandy to clay loam and is characterized by very slow permeability and slow to medium runoff. The erosion hazard is considered slight to moderate.

The D Street Fill was created in 1969 as part of a dredging project in which dredge spoils from the construction of the Sweetwater Channel and the National City Marina were deposited within an existing wetland on habitat similar to that found in Sweetwater Marsh. Today, the D Street Fill consists of vegetated and unvegetated dredge spoil with elevations ranging from 2 to 12 feet above MSL.

#### **3.3.3.2 South San Diego Bay Unit**

Approximately 130 acres of upland are included within the South San Diego Bay Unit with open water and salt ponds dominating the remainder of the Refuge. These upland areas are located at the southeast corner of the Refuge, within the Otay River floodplain. This floodplain consists of soft Alluvial/Bay Deposits overlain with three to five feet of uncompacted fill soils (*GEOCON 1986*). Uncompacted fill soils, characterized as loose, dry to moist, tan to brown silty sands and sandy silts occur throughout much of this upland area, as well as within the levees that surround Pond 20A (*GEOCON 1986*).

The Alluvial/Bay Deposits that occur below the fill soils in the Otay River floodplain consist of loose to moderately dense, silty sands and soft to firm, sandy clays. Exploratory borings conducted in this area in 1986 indicated that a majority of the sand deposits within the upper 15 to 20 feet of the existing grade possess a relative density ranging from approximately 60 to 80 percent (*GEOCON 1986*). A fairly dense gravel layer was also identified approximately 25 to 30 feet below the existing ground surface and groundwater was encountered at elevations ranging from about +3 to +8 feet above MSL.

The Soil Survey (*USDA 1973*) characterizes the soils to the west of Saturn Boulevard and within Pond 20A as Grangeville fine sandy loam, a soil type typically found on alluvial fans and alluvial plains. The fertility of this soil is high and permeability is moderately rapid. Runoff is very slow and the erosion hazard is slight. This soil has a water holding capacity that ranges from six to eight inches.

The area located generally to the east of Saturn Boulevard is characterized as Visalia sandy loam (*USDA 1973*). Similar to Grangeville fine sandy loam, runoff is slow and the erosion hazard is slight. Permeability is moderately rapid and the available water holding capacity is eight to 9.5 inches.

Other soil types within this portion of the Refuge include Riverwash, which occurs within the Otay River channel and Nestor Creek. This soil type consists of a range of particle sizes from sandy to gravelly to cobbly. Along the northern edge of Imperial Beach, between the Bayshore Bikeway and the river channel, the soil is characterized as Huerhuero urban land complex (*USDA 1973*). This soil occurs on marine terraces where the material exposed in cuts consists of unconsolidated sandy marine sediments. This soil type is easily eroded.

No known faults exist within this Refuge Unit, however, the potential for liquefaction is relatively high, as is the potential for settlement should fill soil be placed on existing surfaces. GEOCON (1986) concluded that based on existing soil characteristics the placement of six to 12 feet of fill soil over the existing ground surface could cause settlement ranging from six to 10 inches in depth.

Excavated borings in the vicinity of Pond 20A indicate that at least 40 acres of this area historically supported salt marsh habitat (*Michael Brandman Associates 1989*). This historical salt marsh was established on soils that include a variety of sediment sizes ranging from clay to sand. This is consistent with the types of soils found at other river mouth wetlands, such as the Tijuana River Estuary.

In 1985, a series of exploratory borings were excavated within the salt works on the levees and adjacent upland areas (*GEOCON 1985*). Although this study did not provide any information about soil characteristics on the bottoms of the salt ponds, it does provide general information about the soil characteristics below the ponds. The investigation revealed that the levees are overlain by two to seven feet of fill soils composed of loose to moderately dense, silty sand and sandy gravel. Underlying these fill soils are Bay Deposits, Older Bay/Alluvial Deposits, and Bay Point Formation. The majority of the salt works is underlain by Bay Deposits, which consist primarily of soft bay muds. The thickness of the Bay Deposits varies from about 23 feet near the center of the salt works to less than five feet at the eastern edges of the crystallizer ponds. Older Bay Deposits/Alluvium occurs below the Bay Deposits and is comprised of saturated, firm, silty sandy clays and moderately dense to dense silty sands. The Bay Point Formation was encountered below shallow Bay Deposits and/or Older Bay Deposits/Alluvium, and immediately beneath the fill soils along the southeastern edge of the Refuge. The soil characteristics of the Bay Point Formation include stiff to hard, sandy clays and dense to very dense silty sand (*GEOCON 1985*).

### **3.3.4 Agricultural Resources**

#### **3.3.4.1 Sweetwater Marsh Unit**

The predominant soils within the Sweetwater Marsh Unit include tidal flats, which support coastal wetland habitat, and Huerhuero loam, which occurs in the vicinity of Gunpowder Point (*USDA 1973*). None of the soils within this Refuge Unit are identified as having agricultural importance on the 1998 San Diego County Important Farmland Map (*California Department of Conservation*

2000). However, the property just to the southeast of the Refuge boundary is identified as “Farmland of Local Importance.” Gunpowder Point and the area to the southeast of the Refuge were farmed from about 1946 to 1986. Hothouse tomatoes were the largest crop produced on the site, although some additional row crops were planted in the 1970s and 1980s. No agricultural activities have occurred on the site since 1986.

#### **3.3.4.2 South San Diego Bay Unit**

The Otay River floodplain is overlain by soils that have been identified on the 1998 San Diego County Important Farmlands Map as Prime Farmland (*California Department of Conservation 2000*). The Department of Conservation defines Prime Farmland as land with the best combination of physical and chemical characteristics able to sustain long-term production of agricultural crops. The map also states that the land must have been used for production of irrigated crops at some time during the four years prior to the mapping date. Although this area was identified as Prime Farmland by the State in 2000, the property has not been in production since 1988.

The predominant soils within the area identified as Prime Farmland include Visalia sandy loam and Grangeville fine sandy loam (*USDA 1973*). Both soils are recognized as being good for farming. The site is located within the Maritime Climate Zone, a climate zone with temperatures and humidity that are strongly influenced by ocean conditions. This climate zone is characterized by narrow seasonal and diurnal temperature changes and high humidity which is considered favorable for agricultural production.

From the mid 1930s until about 1988, much of the Otay River floodplain was farmed. A wide variety of irrigated row crops were grown on the site, including bell peppers, beans, tomatoes, cucumbers, cabbage, and celery. Tomatoes were the principal crop until water and labor costs forced a change to alternative truck crops. Drip irrigation, double-cropping, and the use of polyethylene sheeting to protect early plantings from freezes all helped to improve production and increase the potential to compete with other markets. In 1986, the production of cucumbers on the property was profitable. However, due to uncertainties in the marketplace and increasing costs, the land was permanently taken out of agricultural production in 1988 (*CIC Research, Inc. 1987*).

In 1987 CIC Research Inc. prepared an assessment of the physical resources and economic feasibility of continued or renewed agriculture on this property. The results of this assessment indicated, “The overall quality of the site for continued agriculture is only moderate. The resource base is good. However, the location for direct marketing and ability to employ optimum management practices are sub-optimal. Water and labor costs are high relative to competing areas, causing a general rating of site attributes to be only moderate and not sufficient for the current and expected future competitive environments” (*CIC Research, Inc. 1987*).

#### **3.3.5 Hydrology**

The hydrological conditions within the San Diego Bay NWR are influenced by tidal processes and surface water runoff (freshwater flows entering the Refuge from various rivers, creeks, and minor drainages). Tidal inundation is essential to the coastal wetland habitats supported on this Refuge. The ebb and flow of tides within the bay circulate and mix ocean and bay waters and produce currents that influence salinity levels and temperatures throughout the bay (*U.S. Navy 2000*). The water levels in the bay vary with the astronomical tides, with water levels highest during high tide. In the Southern California Bight, the tides are of the mixed, semi-diurnal type, with two highs and two lows of unequal height occurring each lunar day (an average duration of 24.4 hours).

The tidal conditions in San Diego Bay are measured by the National Oceanographic and Atmospheric Administration (NOAA), which operates and maintains a long-term primary tide gage at Navy Pier near downtown San Diego. This gage has been in operation since 1900. Tidal measures collected over a previous tidal epoch (19-year period from 1960 – 1978) have been statistically reduced to obtain long-term average values of Mean Lower Low Water (MLLW), Mean Lower Water (MLW), Mean Tidal Level (MTL), Mean Higher Water (MHW), and Mean Higher High Water (MHHW). The highest observed water level in the bay, 8.35 feet MLLW, was recorded on January 27, 1983, and the lowest observed water level, -2.88 feet MLLW, was recorded on December 17, 1973 (*National Ocean Service Data, publication data 06/03/1991*).

The diurnal difference in the high MHHW and the low MLLW tides in the Bay is 5.6 feet, with extremes of 9.8 feet (*U.S. Navy 2000*). The highest tides occur in January and June. Water levels in the Bay are also affected by storm surge, El Nino-Southern Oscillation events, and long-term changes in sea level. The tidal characteristics in San Diego Bay are provided in Table 3-1. The effects of storm surge on water levels in the bay are relatively small; by contrast, El Nino conditions that tend to occur every four to seven years result in changes in water level that have led to increases in monthly MSLs of up to one foot in the Southern California Bight during the 1997-1998 season. Yearly MSL data recorded at San Diego indicates a rise in sea level of eight inches per century (*California State Lands Commission et. al. 2001*).

Those Refuge habitats that are located within the lowest reach of the watershed are also influenced by the quality and quantity of freshwater flows that pass through the Refuge and ultimately flow into the Bay.

### 3.3.5.1 Sweetwater Marsh Unit

The Sweetwater Marsh Unit is located at the western terminus of two watersheds, the Sweetwater watershed and the Pueblo San Diego watershed. Today, freshwater flows from the Pueblo San Diego watershed, the smaller of the two watersheds, flows into Paradise Marsh via Paradise Creek and Bannister Creek. Paradise Creek enters the northeast corner of Paradise Marsh via a channel

Table 3-1 Tidal Datums for San Diego Bay		
Mean Tidal Datum	Tidal Statistics for San Diego Bay (feet)	
	Local MLLW Datum	NAVD88 Datum
Maximum Measured Water Level (01/27/1983)	8.35	7.70
MHHW	5.73	5.08
MHW	4.98	4.33
MTL	2.96	2.31
MSL	2.76	2.11
National Geodetic Vertical Datum – 1929 (NGVD)	2.72	2.07
MLW	0.94	0.29
MLLW	0.00	-0.65
Minimum Measured Water Level (12/17/1973)	-2.88	-3.53

Source: Published Tidal Datums for NOAA Tide Gage No. 9410170 (San Diego Bay)

under I-5. The creek then flows south through the marsh terminating at the Sweetwater flood control channel. The drainage basin for Paradise Creek is approximately six square miles. Prior to human disturbance, flows from Paradise Creek followed a major slough channel that meandered through a much larger Paradise Marsh, emptying directly into the Bay well to the north of the Sweetwater Channel. The historical alignments of the Sweetwater River and Paradise Creek as they existed in 1859 are illustrated in Figure 3-4.

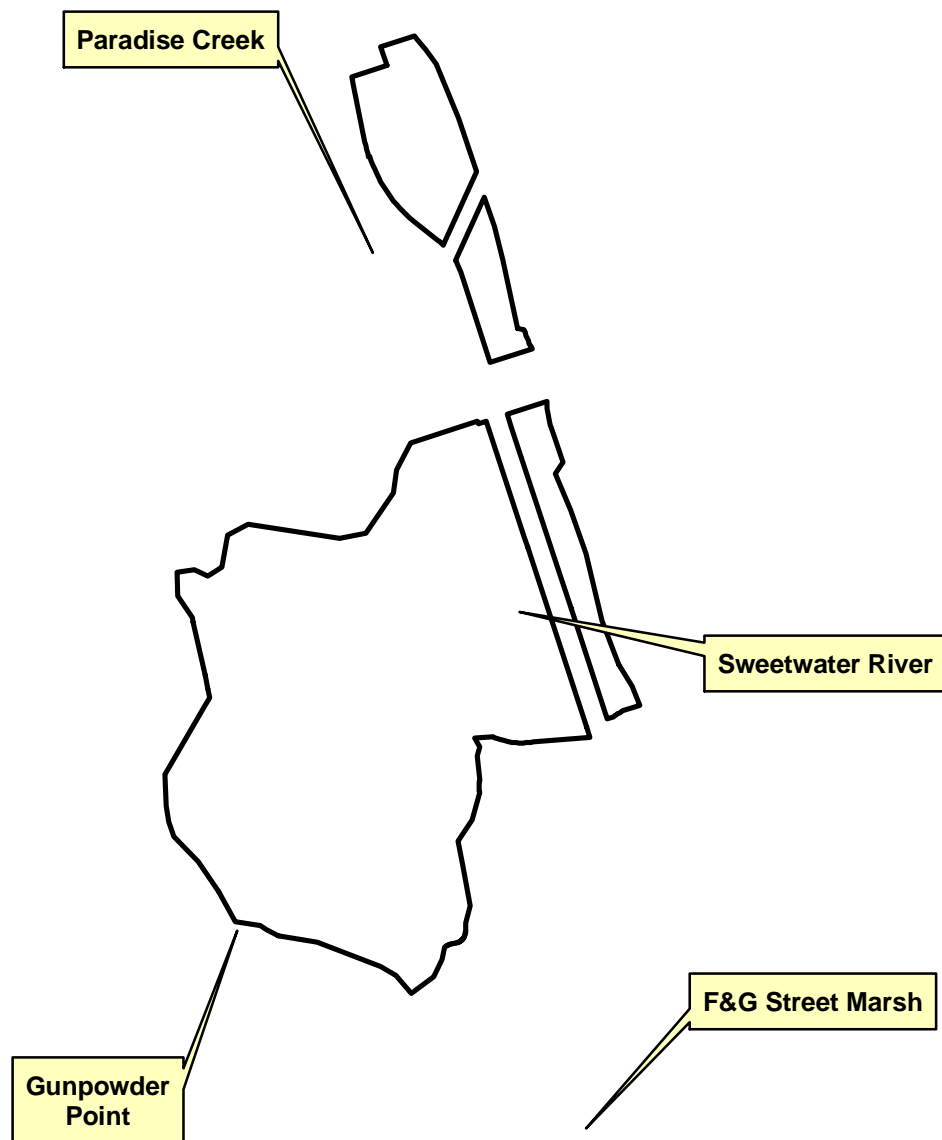
Bannister Creek, with a drainage basin of approximately 0.75 square miles, is a much smaller drainage within the Pueblo San Diego watershed. This creek enters Paradise Marsh from the east, near the southern end of the marsh. This drainage collects runoff from an area developed with industrial uses.

The Sweetwater watershed encompasses approximately 230 square miles and extends from the Bay to the Laguna Mountains. The primary tributary within this watershed is the Sweetwater River, which has undergone significant changes over the past 100 years. Changes to the historic river system began in 1888 with the construction of the Sweetwater Reservoir. This was followed in 1945 by the construction of the Loveland Reservoir near the eastern end of the drainage. The construction of these dams has significantly reduced the volume of freshwater flowing from the watershed into the Bay. The Sweetwater Reservoir controls approximately 84 square miles of the drainage basin, while the Loveland Reservoir controls about 98 square miles of the basin. Major discharges of freshwater flows from the Sweetwater and Loveland Reservoirs occur only when the water levels in the reservoirs are high enough to permit flow over the dam spillways.

The configuration of the lower reach of the river has also been altered. This reconfiguration has significantly reduced the volume and frequency of the freshwater flows entering the intertidal habitats within the Sweetwater Marsh Unit. The first significant alteration to the historic alignment of the lower Sweetwater River occurred in the late 1960s in association with the construction of the D Street Fill. As part of this fill project, the river mouth was relocated to the southwest and a new channel was excavated to the south of the fill. The historical river mouth and slough channel (refer to Figure 3-4) were then buried beneath the 85-acre fill (*Philip Williams & Associates 1990*).

The configuration of the river was once again altered in the 1980s when the Corps began construction of the Sweetwater Flood Control channel. This project converted approximately 3.2 miles of natural river upstream of the marsh into a trapezoidal channel with earth bottom and riprap side slopes. It also diverted the flow of the river from the existing Sweetwater wetlands complex to the flood control channel. To reduce the impact of diverting the majority of the freshwater flows from the marsh, a freshwater diversion weir was constructed within the connector marsh to divert some of the freshwater storm flows from the flood control channel into Sweetwater Marsh via a connector marsh. According to the Service's Biological Opinion for the flood control project, dated March 30, 1988, the 150-foot-wide diversion structure would permit approximately 3,200 cubic feet per second (cfs) to enter Sweetwater Marsh during a combined maximum high tide and 500-year storm. An additional 700 cfs would be expected to enter the marsh from urban areas to the east of I-5. This compares to a 66,000 cfs flow that would have occurred prior to the construction of the flood control channel.

When the flood control channel was constructed, a flashboard weir was installed at the south end of the tidal channel in Paradise Marsh. Although no flashboards were in place during a 1993 study to monitor the morphology of the marsh, monitors observed that the rock sill of the weir was preventing Paradise Marsh from draining below elevations of about 0.0 feet NGVD (*Philip Williams & Associates 1993*). The weir does not appear to dampen the upper portion of the tidal



— Sweetwater Marsh Unit of the SDBNWR

0 500 1,000  
Feet

Sources: Survey of the Coast of the United States, Coastal Survey Office, 1859; USFWS

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cycle, but it does significantly restrict lower tidal drainage. A more recent evaluation of the marsh by the City of National City (2002) indicates that the weir maintains water levels in the marsh at an elevation of approximately 4.5 to 5 feet MLLW. This situation is likely resulting in hypersaline (salinities in excess to sea water) sediment conditions and sedimentation that could lead to channel accretion. Further, the lack of drainage may be affecting soil saturation characteristics and could have a long-term negative effect on vegetation. Philip Williams & Associates suggested in the 1993 monitoring report that the natural slough channel should have an invert elevation at the location of the weir of -2.0 to -4.0 feet NGVD, with a 40 to 50-foot top width and a cross-sectional area of about 120 square feet below MHHW. The report further recommended that if there are no good reasons for maintaining the weir, it should be removed or at least lowered to a depth sufficient to allow a natural channel to develop.

### **3.3.5.2 South San Diego Bay Unit**

The majority of the open water within the southern end of San Diego Bay is included within the approved acquisition boundary of the South San Diego Bay Unit (refer to Figure 1-5). Also included within this Unit are most of the salt ponds within the South Bay Salt Works and the westernmost reach of the Otay River and its associated floodplain.

The majority of the freshwater flows entering the South Bay originate from the Sweetwater and Otay watersheds. Major watercourses in these watersheds include the Sweetwater River, Otay River, Telegraph Canyon Creek, and Nestor Creek. Several smaller drainages also enter the bay including an unnamed drainage that flows between Ponds 15 and 28, entering the bay near the South Bay Power Plant cooling outfall.

The specific drainage basins that terminate near the southernmost end of the Bay include the Telegraph Canyon Creek Basin, which enters the bay just to the north of the Chula Vista Wildlife Reserve; the Otay River Basin, which flows from the east under I-5 and through the southern end of the Refuge; and the South Bay Drainage Group, which includes the Nestor Creek drainage (*U.S. Navy 2000*). All of these drainages have been substantially altered as a result of urban development. Within the Refuge, the natural flow of the Otay River from I-5 west was altered in the early part of the twentieth century to accommodate the development of the salt works and the construction of a railroad. Nestor Creek, which conveys runoff from the adjacent community, enters the Refuge from the south.

The Otay River drains a watershed of approximately 143 square miles, extending for a distance of 25 miles east from San Diego Bay to the Cleveland National Forest. The hydrologic conditions in the lower reach of the watershed are influenced by the presence of the Upper and Lower Otay Reservoirs. These reservoirs, which control approximately 69% of the watershed, reduce the frequency of flows in the river and capture sediments that historically were carried by the river into San Diego Bay. Immediately upstream of the project site, past and current sand and gravel operations have altered the characteristics of the river through open pit mining in the streambed, which has created a series of ponds that act as sediment traps, capturing sediments carried by the river during storm flows.

Historic maps from the mid 1800s illustrate the natural configuration of the Otay River delta prior to human disturbance (refer to Figure 3-2). Prior to disturbance, the Otay River mouth consisted of a series of three or four shifting channels that flowed generally to the northwest across a gentle sloping alluvial fan (*Michael Brandman Associates 1989*). The shading between the major channels that is depicted in Figure 3-2 indicates a tidal marsh environment that was regularly inundated. Near the bayward fringe of this historical salt marsh, smaller tidal-slough type



channels existed that would have conveyed ebb and flood tides to and from the outer marsh plain (*Philip Williams and Associates 2002*).

Since the early 1900s, the Otay River floodplain has experienced significant disturbance that has impaired the natural hydrologic, geomorphic, and ecologic functions of the river/marsh plan complex. These disturbances include the construction of the salt ponds, the realignment and constriction of both the Otay River channel and the Nestor Creek drainage, the construction of the railroad along the south end of the salt ponds, and development and operation of a sewer treatment facility near the northeast corner of Pond 20A in the 1950s and 1960s. In addition, the flood of 1916 deposited an undetermined amount of sediments within the marsh plain.

Today, the Otay River enters the Refuge just west of the I-5 bridge. It extends west and then northwest for approximately 2,500 feet before turning sharply to the west, and then to the southwest, following the southern edge of the salt pond levees. Nestor Creek, a comparatively small tributary to the Otay River, conveys local runoff from the community of Nestor, northward under Palm Avenue, flowing east of Pond 20A until it joins the Otay River. Downstream of the Otay River/Nestor Creek confluence, the Otay River channel is confined between the Pond 20A levee to the south and other salt pond levees to the north, resulting in a hydraulic constriction. Approximately 1,000 feet downstream of the Nestor Creek confluence, the Otay channel splits into two parallel reaches, separated by the railroad right-of-way. The southern reach of this channel appears to carry the majority of the freshwater low flows, while tidal flows extend upstream into both channels. This side-by-side channel configuration continues for roughly 1,500 feet until the two reaches reunite as one channel. The Otay River then continues to flow approximately one mile northwest and then straight north, discharging into the bay (*Philip Williams & Associates 2002*).

The natural upland portion of the Refuge is included within the 100-year floodplain of the Otay River and most of this area is also delineated as floodway by the Federal Emergency Management Agency (FEMA). This lower portion of the Otay River represents a transitional hydrologic zone that is influenced by both the freshwater flows of the river and the tidal flows of the estuarine system that occur near the river mouth. Within this zone, a complex mixing of freshwater, brackish, and tidal flows occurs. Tidal flows from the bay enter the river channel and extend approximately 1,500 feet upstream from the river's confluence with Nestor Creek. The tidal flows, characterized by diurnal (daily) and spring-neap (monthly) variations, inundate the lower reaches of the Otay River and Nestor Creek channels twice daily. In contrast to the tides, freshwater flows from the watershed to the Otay River and Nestor Creek are relatively sparse throughout the year (*Philip Williams & Associates 2002*). During extreme rainfall events, however, freshwater flows would be expected to dominate the system, typically exceeding channel capacity and flooding much of the Refuge's upland area, as well as many of the surrounding properties.

Alterations to the river channel have created a longer channel to the Bay that is constrained on both sides by levees to prevent freshwater overflow into the salt ponds. These two factors severely limit the channel capacity, and during major flood flows, the river backs up and causes shallow flooding over properties located in the immediate vicinity of the Refuge, including the mobile home park located to the south of the Refuge, the parking lots within the commercial center to the east of Saturn Boulevard, and Swiss Park and other properties to the north of Main Street (refer to Figure 2-5 of Appendix I for specific locations). In addition, previous modeling analyses, observed flood levels, and published FEMA Flood Insurance Studies all indicate that during extreme flood events, excess flows from the Otay River will overtop the salt pond levee system at several locations. This was confirmed by recent modeling analyses conducted for the lower Otay River (*Philip Williams & Associates 2002*). The modeling analysis indicated that during a 100-year

flood, localized overbank flooding would begin almost immediately with the onset of a flood event. Overbank flooding would be exacerbated by the hydraulic constriction between the Pond 20A levee to the south and the other salt pond levees to the north. Water levels would continue to rise until the levels exceed the height of the adjacent levees, at which time the flood waters would overflow into the neighboring salt ponds, possibly impacting Ponds 20 and 22. Although the sediment delivery into the ponds from the floodwaters would be low, sediments within the ponds would likely be redistributed in association with levee overtopping. The existing peak water surface elevations under 100-year flow conditions, as determined by the model, are provided in Table 3-2.

Table 3-2 Existing Peak Water Surface Elevations Under 100-Year Flow Conditions		
Location <sup>1</sup>	Ground Level Elevation (feet – NAVD88)	Water Surface Elevation (feet – NAVD88)
A. Approximately 1,000 feet downstream from the I-5 bridge	18.0	18.8
B. Location where the Otay River meets the salt works levee system	19.8	18.2
C. Confluence of the Otay River and Nestor Creek	15.9	17.9
D. Northwestern edge of Pond 20A	14.3	13.0
E. Nestor Creek, approximately 2000 feet upstream from the confluence of the Otay River	17.5	18.2

<sup>1</sup> See Figure 3-5 for comparison locations.

Source: (Philip Williams & Associates 2002)

Soil borings conducted within the Otay River floodplain in 1986 and 1989 demonstrated that groundwater occurs relatively close to the surface. In 1986, test borings encountered groundwater at 3 to 7 feet below the ground surface (+2 to +7 feet MSL), with a wetted zone (capillary fringe) assumed to extend approximately 1 to 2 feet above the recorded groundwater elevation (*GEOCON 1986*). Slightly brackish groundwater (2 to 3 parts per thousand [ppt]) was encountered in 1989, when an additional test boring was conducted in the north central portion of the floodplain (*Michael Brandman Associates 1989*). This investigation suggested that the groundwater elevations observed in 1986 had not changed significantly from the groundwater elevation noted during subsequent testing.

### 3.3.6 Water Quality

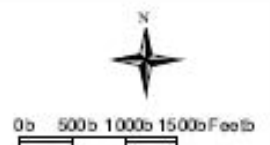
#### 3.3.6.1 Overview

Water quality within the Sweetwater Marsh Unit during the dry season is influenced almost exclusively by tidal action in the bay, while freshwater inputs from Paradise Creek, the Sweetwater River, and various drainages and municipal storm drains influence water quality during periods of measurable rainfall. Although not yet quantified, water quality within this Refuge Unit could also be influenced by the presence of contaminants within the sediments of the marsh and adjacent parcels (see Section 3.3.8, Contaminants). This is particularly true in the vicinity of Paradise Marsh, the east end of Sweetwater Marsh, and F&G Street Marsh.

Within the South San Diego Bay Unit, which includes much of the southern third of San Diego Bay, the quality of the water within the Bay has the potential to influence a significant portion of the wildlife habitat within the Refuge. Water quality within this Unit is also influenced by freshwater flows from the Otay River and Nestor Creek during periods of heavy rainfall.



**Figure 3-5S**  
**Reference Locations for Tables 3-2 and 4-1 Comparing 100-yr S**  
**Water Surface Elevations**



Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)

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### 3.3.6.2 San Diego Bay

Between the early 1800s and the mid to late 1900s, water quality in San Diego Bay suffered serious degradation due to the discharge of untreated municipal sewage and a variety of toxic and nontoxic industrial wastes (*Michael Brandman & Associates 1990*). It has been estimated that in 1952 at least 50 million gallons of sewage and industrial wastes were being discharged into the bay (*U.S. Navy 2000*). The situation continued to deteriorate. In 1960, much of the bay was declared polluted due to high bacteria levels. As a result, all water contact activities were prohibited. It was not until 1964 that domestic sewage discharges into the bay, including those from San Diego, Chula Vista, Coronado, and the Naval Amphibious Base, finally ceased and the discharge was instead routed to an ocean outfall. By the early 1970s, major industrial process discharges had also been diverted to the Metropolitan Sewage System. At about the same time, the Navy began eliminating waste discharges into the bay and by 1980, all sewage and industrial waste discharges into the bay from naval operations ceased (*U.S. Navy 2000*).

Until the 1970s, pollution issues in the bay focused on bacterial contamination from discharged sewage, but as bacterial levels were reduced, the focus on the bay's water quality shifted to contaminants related to the discharge of industrial wastes. The effects of discharging heavy metals and toxicants into the bay were not clearly understood, prompting the initiation of several studies. The results of these studies indicated that much of the Bay's chemical pollution occurred in the bay sediments rather than in the water column. Further studies identified high levels of copper, tributyltin (TBT), polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) in bay sediments, prompting the identification of new actions to control the pollutant levels in the bay.

The San Diego Bay Interagency Water Quality Panel (Panel) was established in 1988 to address the Bay's water quality concerns, as well as to ensure the long-term viability of San Diego Bay. The panel initiated a number of technical studies in order to better understand the water quality issues in the bay. In 1992, the Panel was reauthorized and charged with the development of a comprehensive management plan and a coordinated monitoring program for San Diego Bay. A Comprehensive Management Plan for San Diego Bay was completed in 1998. The purpose of the plan is to "protect, manage, preserve, and enhance San Diego Bay's valuable and unique natural resources and beneficial uses for the enjoyment and benefit of present and future generations."

Also during the 1990s, the California Bay Protection and Toxic Cleanup Program was established to address pollution problems in bays and estuaries statewide. The goals of this program are to provide protection of present and future beneficial uses of the bays and estuarine waters of California; to identify and characterize toxic hot spots; to plan for toxic hot spot cleanup or other remedial or mitigation actions; and to develop prevention and control strategies for toxic pollutants. The 1996 California Bay Protection and Toxic Cleanup Program Report identified five discrete locations of sediment contamination, toxicity to marine life, and benthic community impairments within San Diego Bay (*City of San Diego 2002a*). In response, a Toxic Hot Spots Work Group was formed in 1999 that included the City of San Diego, the Port and the U.S. Navy. This group is working in cooperation with the San Diego Regional Water Quality Control Board (Regional Board) and the Southern California Coastal Water Research Project, to develop a comprehensive toxicity study for the bay.

In 1998, San Diego Bay was included on California's Section 303(d) list as an impaired water body by the California State Water Resources Control Board (SWRCB) due to benthic community degradation and toxicity. Section 303(d) of the Federal Clean Water Act (33 USC 1250, et seq., at



1313(d)) requires States to identify “water quality limited segments” and then rank each segment, taking into account the severity of the pollution and the uses to be made of the waters. A water quality limited segment is defined by regulation as “any segment [of a water body] where it is known that water quality does not meet applicable water quality standards, and/or is not expected to meet applicable water quality standards, even after application of technology-based effluent limitations required by Clean Water Act Sections 301(b) or 306.” The section 303(d) list must include a description of the pollutants causing the violation of water quality standards. The section 303(d) list is required to be reviewed and updated every two years.

In 2002, California’s Section 303(d) list was reevaluated and as a result, the SWRCB amended the previous list to designate only segments of the bay as impaired, rather than the entire bay. Two water quality limited segments identified within the Bay occur in proximity to the San Diego Bay NWR. These include the San Diego Bay Shoreline, north of 24th Street Marine Terminal segment and the San Diego Bay Shoreline, Chula Vista Marina segment. The 24<sup>th</sup> Street Marine Terminal segment is identified due to benthic community effects and sediment toxicity, while the Chula Vista Marina segment exceeds water quality standards for bacterial indicators. These sites were included on the State’s list of water quality limited segments, which was approved by the Environmental Protection Agency (EPA) in July 2003.

As part of the 303(d) listing process, members of the public raised concerns regarding water quality in the vicinity of the South Bay Power Plant. After reviewing the data provided by the public, SWRCB staff determined that it would not be appropriate to list this area as a water quality limited segment because there is not adequate data available to confirm the possibility of impacts to beneficial uses caused by discharges from the power plant. This portion of the South Bay was placed on a Monitoring List because more information is needed to determine if water quality objectives are being attained. The SWRCB has stated that waters on the Monitoring List will be high priorities for monitoring before the next review of the Section 303(d) list is completed. In the past, monitoring at the South Bay Power Plant has focused on chlorine, copper and zinc levels, temperature, and turbidity. Recent studies associated with the plant’s renewal of their discharge permit focused on chlorine, temperature, and turbidity.

The salinity and temperature characteristics of the South Bay differ from those areas to the north. This a result of the natural conditions that exist here, including shallow water depths and poor flushing, as well as human related conditions, such as the discharge of cooling water into the bay from the South Bay Power Plant. With respect to salinity, the area generally between the Coronado Bay Bridge and the Sweetwater Marsh Unit has been described as a seasonally hypersaline region. Here, water is stratified by salinity gradients induced by evaporation. The area south of the Sweetwater Marsh Unit is described as the estuarine region. In this region, residence time of bay water can exceed one month. During the summer months the evaporation rate can be as high as 62.7 inches (159 cm)/year, causing the bay water in this region to become hypersaline, or saltier than seawater. While conducting a fish inventory in San Diego Bay in the late 1990s, Allen (1999) observed that salinities in the bay varied depending upon the location in the bay and the time of year. Allen found that salinities in the bay were typically higher than 34 ppt, the average value for seawater. During the first two years of the study, salinities in the bay varied from 39.8 ppt to 33.4 ppt. In October 1996, the South Bay was particularly hypersaline (39.8 ppt).

Temperatures in the South Bay tend to be higher than in the northern end of the bay, although this is not always the case. In addition to the shallow depth of the water, temperatures in the South Bay are also influenced by the South Bay Power Plant, which discharges heated cooling water into the bay just south of the Chula Vista Wildlife Reserve. Studies of marine life in the

vicinity of the outfall indicate that the thermal pollution from the power plant discharge causes adverse effects to marine life within 1,801 to 3,901 feet (549 to 1,189 meters) of the discharge point (*U.S. Navy 2000*). Adverse effects to the marine life beyond the cooling channel were however determined to be minimal, mainly affecting crustaceans and gastropod mollusks. Additional monitoring is expected to occur as a result of this area's placement on the Monitoring List of Section 303(d) sites. Studies to evaluate the effects of the power plant's cooling intake and discharge on the bay environment have recently been completed in association with a request to reauthorize the plant's National Pollutant Discharge Elimination System (NPDES) permit.

### **3.3.6.3 Freshwater Systems**

Urban runoff from streets, yards, and commercial and industrial areas is collected by the municipal storm water systems and until recently routinely discharged untreated into the bay, adjacent river, or local stream channel. Untreated runoff can not only adversely affect the water quality of receiving waters, but can also adversely affect wildlife and human health. The problem is generally greatest immediately following the first rainfall of an extended dry period (described as the first flush). However, urban runoff can cause problems year round due to many types of urban water uses that result in discharges to the storm water system, such as lawn irrigation, car washing, pool draining, and similar activities.

Ever increasing quantities of nonpoint source pollution in our local drainages lead to calls for new regulations to reduce urban runoff and the levels of containments carried by runoff. The Federal Clean Water Act amendments of 1987 established a framework for regulating storm water discharges from municipal, industrial, and construction activities under the National Pollutant Discharge Elimination System (NPDES) Permitting Program. As a result of these amendments, municipalities throughout the nation are required to obtain a Municipal NPDES Permit. The primary goal of the Municipal Permit is to stop polluted discharges from entering the storm water conveyance system and local receiving and coastal waters.

On February 21, 2001, Regional Board issued a Municipal Storm Water (NPDES) Permit to the City of San Diego, County of San Diego, Port, and 17 other cities. This permit required the development and implementation of storm water regulations to address storm water pollution issues in planning and construction for both public and private development projects. Specifically, development projects are required to include storm water best management practices (BMPs), both during construction and in permanent design, to reduce pollutants discharged from project sites to the maximum extent practicable.

Storm Water Standards have been developed in several municipalities surrounding the Bay that are intended to effectively prohibit non-storm water discharges and reduce the discharge of pollutants from storm water systems during construction and throughout the use of a developed site. In California, the SWRCB, through the nine Regional Boards, administers the NPDES storm water municipal permitting program. Any grading proposed on these Refuges in excess of one acre would require the incorporation of BMPs into the project design as part of the approval of a NPDES Permit (*Water Quality Order 99-08-DWQ - General Permit for Storm Water Discharges Associated with Construction Activity*) from the Regional Board.

In addition, in accordance with Section 401(a)(1) of the Clean Water Act, activities proposed on the Refuge that result in discharge of dredge or fill material into navigable waters of the U.S. would most likely require a 401 Water Quality Standards Certification from the Regional Board. Some of the permits that require a 401 Certification include permits issued under Section 404 of the Clean Water Act and NPDES permits issued by the U.S. Environmental Protection Agency (EPA) under Section 402 of the Clean Water Act. To obtain this certification, the Regional Board must certify

that the project will comply with water quality standards related to beneficial uses designated in the Basin Plan for water bodies in Region 9 (San Diego County), water quality objectives, and the Antidegradation Policy, which requires that existing high-quality waters be protected and maintained, unless the need to lower water quality is justified.

There are many factors known to cause poor water quality including temperature, sedimentation, runoff, erosion, dissolved oxygen, pH, decayed organic materials, pesticides, and an array of other toxic and hazardous substances. Surface and groundwater quality in the Sweetwater and Otay River watersheds have been described as degraded due to concerns related to coliform bacteria, trace metals, and other toxic substances. The sources of these pollutants are urban runoff, agricultural runoff, and faulty sewer and septic systems. Water quality monitoring during the rainy season is currently being conducted for both water basins. In addition, in September 2002 the County of San Diego announced it was initiating a watershed planning effort for the Otay River watershed. The purpose of this planning effort is to develop a Watershed Management Plan that will address issues related to conflicting or redundant wetland regulations, non-point source pollution, coastal water quality, recreation, flood management, and protection of groundwater, surface water supplies, wetlands, and habitat. The plan is scheduled to be completed in 2005.

### **3.3.7 Air Quality**

The Sweetwater Marsh and South San Diego Bay Units are located within the southern coastal region of the San Diego Air Basin. Air quality within the basin is influenced to some extent by climatic conditions, particularly a common atmospheric condition known as a temperature inversion. During a temperature inversion, air temperatures get warmer with increasing height rather than cooler. Inversions occur during the warmer months (May through October) when descending air associated with the Pacific high-pressure cell comes into contact with cool marine air. The boundary between the layers of air represents a temperature inversion that traps pollutants below it. The inversion layer is approximately 2,000 feet MSL during the months of May through October, and approximately 3,000 feet MSL during the winter months (November through April). Inversion layers impact local air quality by inhibiting the dispersion of pollutants, which results in the temporary degradation of air quality.

Air quality in a given location is defined by the concentration of various pollutants in the atmosphere, which is generally expressed in units of parts per million (ppm) or micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ). A large body of scientific evidence associates air pollution exposure with a variety of harmful health effects. To protect human health, the EPA and the California Air Resources Board have adopted ambient (outdoor) air quality standards. These national and state health-based standards identify outdoor pollutant levels that are considered safe for the public, including those individuals most sensitive to the effects of air pollution, such as children and the elderly. These standards also provide the basis for determining the significance of a particular pollutant concentration.

The Federal Clean Air Act (42 U.S.C. §§ 7401-7671q) requires the EPA to set outdoor air quality standards for the nation, referred to as National Ambient Air Quality Standards (NAAQS). To date, standards have been established for sulfur dioxide ( $\text{SO}_2$ ), carbon monoxide (CO), nitrogen dioxide ( $\text{NO}_2$ ), ozone ( $\text{O}_3$ ), particulate matter equal to or less than 10 microns in size (PM10), fine particulate matter equal to or less than 2.5 microns in size (PM2.5), and lead (Pb). The Clean Air Act also permits states to adopt additional or more protective air quality standards if needed. Within California, the California Ambient Air Quality Standards (CAAQS) set parameters for certain pollutants, such as particulate matter and ozone, that provide greater protection of public health than the respective Federal standards. California has also set standards for some pollutants



that are not addressed by Federal standards, including sulfates ( $\text{SO}_4$ ), hydrogen sulfide ( $\text{H}_2\text{S}$ ), and visibility reducing particles. The current national and state ambient air quality standards are provided in Appendix G.

New CAAQS will take effect over the next few years in response to the Children's Environmental Health Protection Act (*Senate Bill 25, Escutia 1999*), which requires the California Air Resources Board (ARB), in consultation with the Office of Environmental Health Hazard Assessment (OEHHA), to "review all existing health-based ambient air quality standards to determine whether, based on public health, scientific literature, and exposure pattern data, [the CAAQS] adequately protect the health of the public, including infants and children, with an adequate margin of safety." This review, which began with an analysis of particulate matter and sulfates, resulted in new, stricter standards for particulate matter. Effective July 5, 2003, the annual-average standard for PM<sub>10</sub> was lowered from 30  $\mu\text{g}/\text{m}^3$  to 20  $\mu\text{g}/\text{m}^3$ , which is not to be exceeded, and a new annual-average standard of 12  $\mu\text{g}/\text{m}^3$ , which is not to be exceeded, was established for PM<sub>2.5</sub>. The 24-hour-average standards of 50  $\mu\text{g}/\text{m}^3$  for PM<sub>10</sub> and 25  $\mu\text{g}/\text{m}^3$  for sulfates were retained. In October 2002, the ARB and OEHHA began their review of the CAAQS for ozone; however, the results of this review are not yet available.

The San Diego Air Basin is managed by the San Diego Air Pollution Control District (APCD). In accordance with its monitoring responsibilities, the APCD maintains an ambient air monitoring network and records air quality readings to determine compliance with national and California standards. Compliance with air quality standards is measured, based on these records,

Specific geographic areas are classified as either "attainment" or "nonattainment" areas for each pollutant based upon the comparison of measured data with NAAQS and CAAQS. When an air basin is in compliance with these standards, it is designated as an attainment area. Conversely, when an air basin is not in compliance with a National and/or California air quality standard, it is designated as a nonattainment area for that pollutant. The San Diego Air Basin is currently designated by the State of California as a "serious" nonattainment area for  $\text{O}_3$  and a nonattainment area for PM<sub>10</sub> and PM<sub>2.5</sub>. In 2001, the county met the one-hour National standard for ozone and was recently redesignated from a serious nonattainment area to an attainment area. The air basin is, however, a nonattainment area for the Federal eight-hour ozone standards. In February 2004, the State recommended to the EPA that the San Diego Air Basin be designated a nonattainment area for the Federal PM<sub>2.5</sub> standards.

Ambient air pollutant concentrations in the basin are measured at ten monitoring stations operated by San Diego APCD. The monitoring stations located closest to the Refuge are in Chula Vista and downtown San Diego (San Diego-Logan Avenue). Since 1999, the region has experience consistent improvement in attaining the national and state standards for  $\text{O}_3$  concentration over a one-hour period. The concentration of PM<sub>10</sub> in the South Bay region has remained relatively constant, with State standards exceeded each year. National and state standards for PM<sub>2.5</sub> have been exceeded at the downtown monitoring station each year since 1999 and at the Chula Vista station two out of the last five years. Both stations have exceeded the state PM<sub>2.5</sub> standards since 1999.

The most significant regional sources of  $\text{O}_3$ ,  $\text{NO}_2$ , and CO are automobiles and other on-road vehicles.  $\text{O}_3$  is formed by the reaction of volatile organic compounds (VOC) and oxides of nitrogen ( $\text{NO}_x$ ), which are combustion products from gas and diesel engines. Other important sources of VOC are paints, coatings and process solvents. The major sources of PM<sub>10</sub> are construction, demolition, and dust from paved and unpaved roads.

In addition to monitoring regional ambient air quality, the San Diego APCD also evaluates and issues air quality permits to ensure that proposed new and changed operations and industrial equipment meet emission standards. Construction and operation permits are required for any operation or equipment capable of emitting air contaminants. Persons building, altering, or replacing equipment, which may emit air pollutants, are required to obtain an Authority to Construct Permit. In addition, persons operating equipment, which may emit air pollutants, are required to obtain a Permit to Operate. The Rules and Regulations established for the APCD do not specifically address grading projects and no permit is required for construction. However, the APCD does have the authority to regulate construction activities that meet the definition of a “nuisance” as provided in Rule 51 of the APCD Rules and Regulations. Rule 51 states: “A person shall not discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance or annoyance to any considerable number of persons or to the public or which endanger the comfort, repose, health or safety of any such persons or the public or which cause or have a natural tendency to cause injury or damage to business or property.” In the case of large-scale grading operations, such as those required to restore the Otay River floodplain, the APCD may require specific measures to minimize the generation of dust during excavation.

Rule 1501 (Conformity of General Federal Actions) of the APCD Rules and Regulations requires that a Federal agency must, when applicable, make a determination that a Federal action conforms to the state implementation plan for achieving the NAAQS before the action is taken. A conformity determination is required for each pollutant, where the total direct and indirect emissions in a nonattainment or maintenance area caused by a Federal action would equal or exceed any of the following rates:

PM<sub>10</sub> – 100 tons/year,  
Ozone (NO<sub>x</sub>), SO<sub>2</sub> or NO<sub>2</sub> – 100 tons/year,  
Ozone (VOCs) – 100 tons/year,  
Carbon monoxides – 100 tons/year, or  
Lead (Pb) – 25 tons/year.

The requirements of Rule 1501 do not apply to Federal actions where the total of direct and indirect emissions is below these emission levels. However, when the total of direct and indirect emissions of a pollutant from a Federal action represents 10 percent or more of an area’s total emissions of that pollutant, the action is defined as a regionally significant action. Such actions would require a conformity determination and must comply with all reporting requirements described in section 1551.855 of Rule 1501.

### **3.3.8 Contaminants**

#### **3.3.8.1 Introduction**

Contaminants are substances (human-made or naturally occurring) that enter the air, water and land in a variety of ways and originate from many different sources. Contaminants may include pesticides, such as dichlorodiphenyltrichloroethane (DDT) and chlordane; industrial chemicals and by-products, such as polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) and other dioxins; and toxic elements, such as mercury and lead. These substances can be individually toxic, or they may trigger negative effects to ecosystems by alteration of normal biochemical processes. Contaminants may also interact with various other biological or physical processes that can result in detrimental effects to a variety of receptor organisms.

As the primary Federal agency dedicated to protecting wildlife and their habitats, the Service conducts contaminant studies on important wildlife species, such as migratory birds, anadromous fish, and threatened and endangered species. These and other studies confirm that many environmental contaminants can alter reproductive system function in adult animals and affect early life stages of fish, mammals, and birds. The Service's contaminants specialists, in cooperation with the U.S. Geological Survey, Biological Resources Division's Biomonitoring of Environmental Status and Trends (BEST) Program, have also developed tools such as the Contaminants Assessment Process (CAP) to assist in evaluating contaminant threats to National Wildlife Refuges, as well as other Service lands.

The CAP provides a standardized approach for documenting and assessing contaminant threats to lands and biota, and involves two primary components: 1) a retrospective analysis of known and suspected contaminant sources and contaminated areas, and the investigation of existing or potential contaminant transport pathways; and 2) a determination of Refuge areas that are vulnerable to spills and/or contamination. This data can then be used to increase awareness and understanding of contaminant issues and how they might affect trust resources. The CAP assists Refuge staff in prioritizing necessary sampling and/or cleanup actions, develop proposals for future investigations, and initiate pollution prevention activities. CAPs have recently been completed for the Sweetwater Marsh and South San Diego Bay Units.

### **3.3.8.2 Sweetwater Marsh Unit**

The Sweetwater Marsh Unit adjoins the highly urbanized cities of National City and Chula Vista and is situated at the end of the watershed. Urban runoff and storm water from industrial, commercial, and residential areas carry pollutants, such as coliform bacteria, trace metals (particularly copper and zinc), and other toxics directly into Paradise Marsh and Sweetwater Marsh. In the past, the lands within and adjacent to this area were utilized for industrial, agricultural, and landfill purposes. These past and present uses represent potential sources of contaminants that could adversely affect refuge resources.

Recent investigations have identified the remains of a former municipal burn dump within and adjacent to the northeastern portion of the Refuge. Over the years, these deposits have introduced contaminants onto Refuge lands and waters, representing a potential threat to refuge resources. The primary threat relates to the burn ash deposits. Burn ash was produced when rubbish and other solid waste was reduced at the dump site through the practice of burning. This was a common method of solid waste disposal in San Diego County until about the mid 1970s. The burn ash present at such sites commonly contains heavy metals, most notably lead, and other chemical constituents that represent a threat to human health and safety. Analyses of limited sediment and groundwater sampling in this area have detected elevated concentrations of arsenic, cadmium, copper, lead, mercury, nickel, zinc, and polychlorinated biphenyls (PCBs). Volatile organic compounds (VOCs) were also detected.

The former dump, which operated in this area between the 1920s and the 1950s, was used primarily as a rubbish disposal site. Usable items and scrap metal were removed and the remaining rubbish was burned and dispersed into Paradise Marsh (*California Integrated Waste Management Board and Geologic Associates 2003*). When this operation ended, the disposal area was graded and leveled, creating what is now referred to as the North Fill Bank. This fill bank consisted of a 15- to 23-foot deep fill area and associated slope composed of undocumented fill and construction debris (*Ninyo & Moore 1998*). A portion of this former dump site occurs within the northern end of the Refuge Unit, where much of the debris was deposited within the fill bank located immediately to the north of Paradise Marsh. In 2004 and 2005 a site cleanup project was implemented by the State of California in cooperation with the City of National City and the

Service. Remediation involved the removal of miscellaneous debris from the fill bank, the regrading and capping of the fill bank slope with two feet of clean soil, and the revegetation of the capped slope with plant species native to the immediate area. Storm water runoff controls were also provided to keep runoff from flowing over the capped slope.

Gunpowder Point (refer to Figure 1-3) was the site of various industrial and agricultural activities over the decades, therefore, contaminants such as metals, hydrocarbons, pesticides, and fertilizers could be present in the soil and/or the groundwater. In August 1988 a contaminants remediation project was implemented on Gunpowder Point involving the removal of approximately 3,000 gallons of waste oil and 50 fifty-five gallon drums of solids from two concrete vaults (*Woodward-Clyde Consultants 1989*). Following removal of the hazardous wastes, the vaults were demolished and removed from the site. Polyurethane sheeting is also known to be buried on the property beneath a shallow cap of soil and nonnative vegetation. The sheeting was disposed of in this manner by a previous agricultural leaseholder.

Previously conducted limited investigations of the dredge spoils within the D Street Fill (refer to Figure 1-3) found detectable levels of petroleum hydrocarbons and some metals. The concentration levels, however, were relatively low for all constituents detected.

Potential sources of contaminants in the F&G Street Marsh (refer to Figure 1-3) include illegal dumping in the northern portion of the marsh and the introduction of runoff into the south end of the marsh from a storm water conveyance system that has collected runoff from an adjacent aviation and aerospace manufacturing facilities for over 60 years. Analyses of recent soil and groundwater sampling indicate the presence of excessive levels of lead, mercury, cadmium, zinc, dioxins, and total recoverable petroleum hydrocarbons (TRPHs) in the sediments and groundwater that occur in the north end of the marsh. In addition, the presence of VOCs and specific metals (particularly chromium and lead) were detected at the southern end of the marsh.

Refuge resources may also be exposed to contaminants present in bay water. San Diego Bay has a long history of contamination. Studies have shown that constituents of concern are present in the water column, as well as in bay sediments. These and other contaminants may bioaccumulate in invertebrates, fish, and plants and eventually be transferred to avian and terrestrial species that feed on these organisms. California horn snail, fiddler crabs, estuarine fish, and various migratory and resident birds may be adversely affected as a result of bioaccumulation.

A contaminants assessment conducted by the Carlsbad Fish and Wildlife Office in 2000 indicated that sediment and biota (crabs and small fish) showed elevated concentrations of several metals or metalloids (i.e. arsenic, boron, cadmium, chromium, copper, mercury, lead, nickel, and zinc) that normally occur in trace concentrations in the environment (*USFWS 2000b*). Sample sites for this study included Gunpowder Point, the mouth of the Sweetwater River, Paradise Creek, and F&G Street Marsh. Total PCBs and copper concentrations in invertebrates that represent an important food source for many birds supported by the Refuge were found at levels above dietary thresholds for birds. Investigations of contaminant levels in plants also found that toxicity levels for copper and lead exceeded accepted threshold standards. Impacts to plants due to copper toxicity include iron chlorosis, thick roots, and the inability to put forth new roots. Excessive levels of lead in plants that are a food resource for some species of birds may result in a wide range of sublethal effects or death for those birds that feed on these plants. Results also indicated elevated levels of zinc in some fish. Exposure to high levels of zinc can impact fish growth, reproduction, and survival. Zinc levels in those species of fish that are considered an important food resource for birds were found to be within acceptable levels for bird consumption.

Contaminant assessments are currently being conducted for various portions of the Refuge, including Paradise Marsh and the F&G Street Marsh. The purpose of these assessments is to characterize the presence and extent of constituents of concern within marsh sediments, benthic infauna, and other biota present on the Refuge. Additional studies are also recommended in the CAP that was completed for this Refuge Unit in 2004.

### **3.3.8.3 South San Diego Bay Unit**

Located immediately adjacent to the urbanized communities of Chula Vista, San Diego, and Imperial Beach, this Refuge Unit receives urban runoff and storm water from upstream industrial, commercial, and residential areas. In addition, past and ongoing uses within and adjacent to the Refuge are known to have introduced contaminants onto Refuge lands, while other uses may have introduced contaminants that have not yet been verified. Pre-acquisition surveys conducted by the FWS have confirmed the presence of contaminants on Refuge lands and within San Diego Bay. Such contaminants include the widespread presence of organochlorine pesticides within the Otay River floodplain and detectable levels of barium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc just to the northeast of Pond 20A. The source of the organochlorine pesticides is directly related to the historic use of this property for agricultural production, primarily tomatoes and other truck crops (cucumbers, squash and celery). A sewer treatment plant that operated within the Otay River floodplain between the mid 1950s and the early 1960s is considered the source of the various metals detected in some of soil samples.

With the exception of a few sediment samples that were analyzed during a Level III pre-acquisition survey, virtually no information is available regarding the environmental condition of the sediments within the salt ponds. Activities associated with commercial solar salt production at this site could have resulted in the introduction of various constituents of concern into the system. Several potential contaminant issues have been identified that warrant further investigation. These relate to the past practice of permitting the discharge of cooling waters from the South Bay Power Plant into the salt ponds and the current practice of redepositing brines back into the pond system. The completed CAP for this Refuge Unit recommends the development and implementation of a sampling plan to characterize the nature and extent of contamination within sediments, surface water, and brine invertebrates within the salt pond system.

Various studies of San Diego Bay have also documented the presence of constituents of concern within the water column. These and other contaminants may bioaccumulate in invertebrates, fish, and plants and eventually be transferred to avian and terrestrial species that feed on these organisms.

A Level III Preacquisition Contaminant Survey was prepared for the proposed South San Diego Bay Refuge in 1991. The need for this level of analysis resulted from observations of numerous dead gulls within the proposed Refuge; the potential for trace elements that could pose a threat to trustee resources; and elevated levels of contaminants in some Caspian tern (*Hydroprogne caspia*) eggs. The survey identified DDE (dichlorodiphenyldichloroethylene), a breakdown product of DDT, in Caspian tern eggs. As a result of these findings and the lack of quantifiable data related to contaminants on the future Refuge site, a baseline contaminant study was recommended (USFWS 1991). In response, a study of organochlorine (used in pesticides such as DDT) contaminants in eggs of tern species and western snowy plovers nesting in San Diego Bay was conducted in the early 1990s (USFWS 1997). This study did not identify significant levels of contaminants within the eggshells of eggs that failed to hatch at the salt works and elsewhere in the bay; however, detectable levels of the pesticides oxychlorane and DDE were found in eggs collected from the salt works. In addition, all of the samples analyzed had detectable

concentrations of PCBs. The report concluded that additional studies are needed and the Service continues to pursue funding to complete these studies.

Recent studies conducted as part of the Bight '98 Regional Survey (*City of San Diego 2004*) indicate that contamination remains widespread in San Diego Bay sediments, as well as in the tissues of various species of fish. Contaminants of concern, such as chromium, copper, lead, mercury, zinc, PCBs and PAHs, continue to be present at levels that exceed one or more sediment quality criteria thresholds. Mercury, zinc, PCBs, and DDT occurred in over 80% of fish tissues. The overall level of contamination in the Bay does however appear to be less than in previous decades.

Additional contaminants assessments to characterize the presence and extent of constituents of concern within various portions of this Refuge Unit are recommended in the CAP that was completed in 2004.

### **3.3.9 Noise**

#### **3.3.9.1 Introduction**

Noise, which can be defined as unwanted or undesired sound, is generally considered disturbing or annoying to humans because of its pitch and/or its loudness. Pitch is the property of sound that fluctuates with variation in the frequency of vibration. Higher pitched signals sound louder to humans than sounds with a lower pitch. Loudness is intensity of sound waves combined with the reception characteristics of the ear. The effects of noise on people can include general annoyance, interference with speech communication, sleep disturbance and, in the extreme, hearing impairment. The combination of noise from all sources near and far is defined as the Ambient Noise Level.

Several noise measurement scales are used to describe noise in a particular location. A decibel (dB) is a unit of measurement that indicates the relative amplitude of a sound. Because the human ear is not equally sensitive to all frequencies within the sound spectrum, a method called “A-weighting” is used to filter noise frequencies that are not audible to the human ear. The “A-weighted” noise scale (dBA) gives greater weight to the frequencies of sound most sensitive to the human ear.

Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10-decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Sound levels for typical noise sources and noise environments are presented in Table 3-3.

Sound levels are rarely constant in the natural or built environment; therefore, noise levels are often presented as average noise levels over a period of minutes or hours. Such noise levels are expressed as dB Leq. The most common averaging period is hourly, but Leq can describe any period of time. When the one-hour average is used, the noise level is stated as dB Leq, however if a different period of time average is used, such as an 8-hour average, the measurement would be described as Leq(8). Construction noise standards are usually stated as average noise levels over a period of 1, 8 or 12 hours.

During the evening and nighttime hours, human sensitivity to noise increases, particularly because excessive noise can interfere with the ability to sleep. In fact, noise levels as low as 35 to 45 dBA

**Table 3-3  
Sound Levels of Typical Noise Sources and Noise Environments**

Noise Source at a Given Distance	A-Weighted Sound Level in Decibels (dB)	Noise Environment	Subjective Impression of Loudness (Relative to a Reference Loudness of 70 dB*)
	140		
Military Jet Take-off w/ Afterburner (50 ft)	130	Carrier Flight Deck	
Civil Defense Siren (100 ft)			
Commercial Jet Take-off (200 ft)	120		<b>Threshold of Pain</b> *32 times as loud
Pile Driver (50 ft)	110	Rock Music Concert	*16 times as loud
Ambulance Siren (100 ft)	100		<b>Very Loud</b> *8 times as loud
Newspaper Press (5 ft)			
Power Lawn Mower (3 ft)			
Motorcycle (25 ft)	90	Boiler Room Printing Press Plant	*4 times as loud
Propeller Plane Flyover (1000 ft)			
Diesel Truck, 40 mph (50 ft)	80	High Urban Ambient Sound	*2 times as loud
Garbage Disposal (3 ft)			
Passenger Car, 65 mph (25 ft)			
Living Room Stereo (15 ft)	70		<b>Moderately Loud</b> *70 dB (Reference Loudness)
Vacuum Cleaner (3 ft)			
Electronic Typewriter (10 ft)			
Normal Conversation (5 ft)	60	Data Processing Center Department Store	*1/2 as loud
Air Conditioning Unit (100 ft)			
Light Traffic (100 ft)	50	Private Business Office	*1/4 as loud
Bird Calls (distant)	40	Lower Limit of Urban Ambient Sound	<b>Quiet</b> *1/8 as loud
Soft Whisper (5 ft)	30	Quiet Bedroom	
	20	Recording Studio	<b>Just Audible</b>
	10		<b>Threshold of Hearing</b>
	0		

have been documented by the California Department of Public Health to cause sleep interruption (*County of San Diego 1980*). To account for this increased sensitivity, 24-hour descriptors have been developed that incorporate penalties for noise generated during evening and nighttime hours. One such descriptor, used primarily in California, is the Community Noise Equivalent Level (CNEL). CNEL is a 24-hour weighted average measure of community noise that adds 5 dB to the average hourly noise levels during evening hours (7 P.M. to 10 P.M.) and 10 dB to the average hourly noise levels at night (10 P.M. to 7 A.M.). Another 24-hour descriptor is the Day/Night Average Sound Level (Ldn). Ldn differs from CNEL in that it weights only the nighttime hours. Noise contours developed by CNEL and Ldn procedures rarely differ by more than one decibel.

### **3.3.9.2 Sensitive Noise Receptors**

To evaluate the effects of increased noise levels on the surrounding environment, it is important to identify the noise sensitive receptors in the vicinity of a project area. Noise sensitive receptors generally include land uses associated with indoor and/or outdoor human activities that may be



subject to stress and/or significant interference from noise. These include single- and multi-family residences and associated outdoor use areas, mobile homes, hotels and motels, hospitals, nursing homes, and other related medical care facilities, educational facilities, libraries, churches, parks, and other places where the public gathers. Wildlife areas can also be a noise sensitive receptor, particularly during the breeding season. Noise issues related to wildlife are addressed under the Vegetation and Wildlife Habitat sections of this document.

The primary uses surrounding the Sweetwater Marsh Unit are industrial or commercial in nature and are not considered sensitive noise receptors. Existing sensitive noise receptors within the Refuge include the Chula Vista Nature Center and the Refuge's nature trails located on Gunpowder Point. The land to the east and southeast of the Refuge, referred to as the Mid-Bayfront area, is currently vacant; however, the Chula Vista General Plan designates this land for mixed-use development, including residential uses, which would be considered noise sensitive receptors. Effects on these uses would only be considered if the units have been constructed and are occupied prior to the completion of enhancement/restoration activities within the Refuge.

A variety of noise sensitive receptors occur in proximity to the South San Diego Bay Unit. These include a mobile home park, located to the south the Otay River floodplain within the City of San Diego; residential uses and an elementary school located along the south end of the bay within the City of Imperial Beach; and residential development located just to the west of the Refuge boundaries in the City of Coronado.

The State of California recognizes the relationship between noise and noise-sensitive land uses, and emphasizes the need to control noise at the local level through land-use regulation. Section 65302(g) of the California Government Code requires that each City have a Noise Element as part of its General Plan. Grading activities associated with the various enhancement/restoration proposals being considered for the Sweetwater Marsh Unit in the CCP would be subject to the noise standards and/or guidelines adopted by the cities of National City and/or Chula Vista, as established by their respective General Plans and zoning ordinances. Grading activities associated with the enhancement/restoration proposals under consideration for the South San Diego Bay Unit could be subject to the General Plan and zoning ordinance standards and/or guidelines adopted by one or more of the following cities: San Diego, Imperial Beach, Chula Vista, and Coronado. All of these jurisdictions have adopted construction noise standards that would be applicable to such projects. These noise standards, which are typically located in a noise ordinance, include limitations on the hours when construction can occur, maximum allowable noise levels, or both. In addition to specific noise standards, each ordinance typically includes a "General Prohibition" that prohibits the generation of noise that is disturbing, excessive or offensive, and causes discomfort or annoyance to reasonable persons of normal sensitivity. The applicable construction noise limits for each jurisdiction in which habitat enhancement and/or restoration activities could occur are provided in Table 3-4. It should be noted that most jurisdictions have included specific procedures for obtaining variances from construction noise limitations within their noise ordinance.

Note that for multiple dwelling unit residential development in the City of Chula Vista, interior noise levels cannot exceed 50 dBA for more than one minute per hour or 45 dBA for more than five minutes per hour. If, however, the ambient noise level already exceeds these standards, the allowable noise level is equivalent to the ambient level (*City of Chula Vista 2003*).

### **3.3.9.3 Existing Noise Environment**

Existing noise levels vary throughout the Sweetwater Marsh Unit, with the most significant noise generated by the military, commercial, and private fixed wing and rotary wing aircraft that fly

Table 3-4 Summary of Applicable Construction Noise Limits			
Receiver Site	Jurisdiction	Construction Noise Limits	Prohibited Construction Hours
Pepper Park	National City <sup>2</sup>	75 dBA <sup>1</sup> at or within the boundaries of residential use 85 dBA <sup>1</sup> at or within the boundaries of semi-residential/commercial <sup>1</sup>	7pm – 7 am Monday through Friday; all weekends; holidays
Mid-Bayfront (future)	Chula Vista <sup>3</sup>	55 dBA <sup>1</sup> at or within the boundaries of residential use (except multiple dwellings), 7 am – 10 pm (weekdays) and 8 am – 10 pm (weekends) and 45 dBA <sup>1</sup> 10 pm – 7 am (weekdays) and 10 pm – 8 am (weekends). 60 dBA <sup>1</sup> at or within the boundaries of multiple dwelling residential, 7 am – 10 pm (weekdays) and 8 am – 10 pm (weekends) and 50 dBA <sup>1</sup> 10 pm – 7 am (weekdays) and 10 pm – 8 am (weekends). 65 dBA <sup>1</sup> at or within the boundaries of commercial, 7 am – 10 pm (weekdays) and 8 am – 10 pm (weekends) and 60 dBA <sup>1</sup> 10 pm – 7 am (weekdays) and 10 pm – 8 am (weekends).	Not applicable
Mobile Home Park	San Diego <sup>4</sup>	75 dBA Leq (12) at residential properties	7 pm – 7 am Monday - Saturday; Sundays; City holidays
Residential Uses south of the Bay	Imperial Beach <sup>5</sup>	75 dBA <sup>1</sup> for any use	10 pm - 7 am
Residential Uses west of the Bay	Coronado <sup>6</sup>	75 dBA Leq at residential properties	7 pm - 7 am Monday-Saturday; Sundays; legal holidays

<sup>1</sup> Not to be exceeded at anytime.

<sup>2</sup>National City Municipal Code Section 12.10.160.

<sup>3</sup>Chula Vista Municipal Code Section 19.68.030.

<sup>4</sup>San Diego Municipal Code Section 59.5.0404; the section also allows exception by permit of the Noise Abatement and Control Administrator.

<sup>5</sup>Imperial Beach Municipal Code Section 9.32.020H; Section 9.32.060 allows exemption by permit of the City Manager.

<sup>6</sup>Coronado Municipal Code Section 41.10.40, the section also allows exceptions via a Noise Control Permit.

over Refuge lands. Other sources of noise in the vicinity of this Refuge Unit include vehicle traffic on I-5, boat operations in the adjacent navigation channel, and Port and other industrial activities that occur immediately to the north and northwest.

Within the South San Diego Bay Unit, noise levels are influenced by aircraft activity and boating on the bay, and to a minor extent by vehicular travel on I-5 and SR-75 and pedestrians and bicyclists using the Bayshore Bikeway.

## **3.4 Biological Resources**

### **3.4.1 Historical and Regional Context**

#### **3.4.1.1 Overview of Historical Habitat Changes in the Bay**

Early accounts indicate that there was little evidence of human related alterations to the ecosystems of San Diego Bay before the first Spanish settlement was established on the bay in 1769. The minor disturbances that did occur resulted from food gathering activities of the Native Americans who lived in the area (*Michael Brandman Associates, Inc. 1990*). After 1769, activities within the bay and along the shoreline increased as the bay became an active port for Spanish transport vessels. By the 1800s, the activities associated with California's whaling industry further increased the level of disturbance. The first major change to the bay's natural habitat occurred in 1850 with the construction of a pier at the end of Market Street. This was followed in 1853 and 1854 by the permanent diversion of San Diego River flows from San Diego Bay to Mission Bay (then called False Bay) (*U.S. Navy 2000*). This river diversion project resulted in the substantial loss of salt marsh and intertidal mudflat habitat along the northern edge of San Diego Bay. In 1859, the Bay encompassed approximately 18,500 acres (refer to Figure 3-2). The dominant habitats included shallow subtidal (6,400 acres) and intertidal mudflats (6,148 acres), representing 35 percent and 33 percent of the bay's total acreage, respectively. At that time, deep subtidal habitat accounted for only 12 percent (2,212 acres) of the bay's total acreage (*U.S. Navy 2000*).

The first major dredging project in the bay occurred in 1914 and substantial filling around the perimeter of the bay occurred between the 1930s and 1940s. This filling, which was conducted to accommodate bayfront development, eliminated intertidal mudflat and salt marsh habitat along much of the north and northeastern portions of the bay. Major changes to the subtidal habitats in the north and central portions of the bay occurred between 1940 and 1970, when natural shallow subtidal habitat was converted to deep water to accommodate commercial and military shipping channels and port facilities (*U.S. Navy 2000*).

Today, deep subtidal habitat accounts for 28 percent (4,443 acres) of the total acreage in the bay, an increase of 16 percent from 1859. Shallow subtidal habitat currently occupies about 24 percent (3,734 acres) of the bay and only six percent (979 acres) of the bay supports intertidal mudflat habitat, a 27 percent decrease in the total mudflat acreage present in the bay in 1859 (*U.S. Navy 2000*). These changes in habitat type have had a direct impact on the distribution and abundance of many plant and wildlife species historically supported by the natural habitats associated with San Diego Bay.

#### **3.4.1.2 Historical Habitat Changes within Each Refuge Unit**

##### **Sweetwater Marsh Unit**

In the vicinity of what is today the Sweetwater Marsh Unit, human activity has resulted in significant disturbance to coastal wetland and surrounding native upland habitats.

Historically, a network of tidal channels connected the marshes of the Sweetwater wetlands complex, including Paradise Marsh, Sweetwater Marsh, and the E Street Marsh. This interconnected wetland complex extended from the marsh's current southern boundary northward to Paradise Creek and eastward into much of what is now National City. In addition, seasonal freshwater flows entered the marsh complex from Paradise Creek and the Sweetwater River.

Over the decades, the marsh complex's tidal network has been severely altered as a result of filling for roadways and development and dredging to create shipping and flood control channels. In addition, the construction of the Sweetwater Dam in 1888, the Loveland Reservoir in 1945, and the combined Sweetwater River Flood Control/State Route 54 project in the 1980s resulted in a dramatic reduction in the volume of freshwater flows entering the marsh complex. The implementation of the combined Federal project also resulted in the permanent loss of 15.6 acres of wetland habitat; of this, approximately 9.7 acres of the impacted wetland habitat were filled for the highway project and 5.9 acres were dredged to create a deep water flood control channel (*USFWS 1988*).

The native vegetation on Gunpowder Point, a natural upland area within the Sweetwater Marsh Unit, was continuously disturbed by industrial and agricultural uses from at least 1916 to 1988. As a result, only remnants of the original native upland vegetation exist on site. The other upland area within the Refuge is the D Street Fill. Created in 1969 from dredge spoil associated with the development of the 24<sup>th</sup> Street Marina and associated channel, this disposal operation eliminated 108 acres of marshland within the Sweetwater Marsh complex (*USFWS 1979*).

### **South San Diego Bay Unit**

Although spared the impact of extensive dredging, the South Bay has nevertheless experienced significant habitat loss. Changes to the habitats in the South Bay began in 1871 with the construction of the La Punta Salt Works, a small-scale solar salt evaporation facility. Between 1911 and 1916, the area utilized for solar salt production was expanded to include the entire end of the South Bay. In 1933, the land now occupied by Ponds 11, 12, 14, and 15 was acquired for incorporation into the salt works. By 1942, Ponds 12, 14, and 15 had been constructed, followed later by the construction of Pond 11 (*U.S. Coast and Geodetic Survey Chart 1942*). Based on the existing elevations of these ponds, it appears that in creating the salt ponds, significant portions of the intertidal mudflat and salt marsh habitat at the south end of the bay were eliminated.

Some dredging, although limited, has occurred in the South Bay. In the late 1960s, dredging was conducted to create the Chula Vista Marina and the mooring areas around the Coronado Cays. Several boat navigation channels have also been created to provide access to the Chula Vista Marina and adjacent shipyard, as well as to the Coronado Cays. The last major dredging activity to occur in the South Bay took place in the late 1970s, when a channel was created in Emory Cove. Tidelands now filled to support development occurred along the bayfront in National City, between G and J Streets in Chula Vista, and at the site of the Chula Vista Wildlife Reserve (*Michael Brandman Associates, Inc. 1990*). The native upland and wetland habitat of the Otay River floodplain was all but eliminated during the twentieth century as a result of industrial, agricultural, and municipal activities. Maps dating back as far as 1916 depict the Otay River in its present channelized configuration. A narrow corridor of salt marsh, freshwater marsh, and native riparian habitat are supported within the river channel, and remnant maritime succulent scrub habitat can still be found in the vicinity of the railroad right-of-way that extends between the south end of the salt works and the Otay River channel.

### **3.4.1.3 Regional Context**

#### **Overview**

Coastal Southern California includes a unique combination of physical features, climate, and hydrology that have resulted in a diversity of plants and wildlife unlike any other

region in North America. Southern California also has the distinction of having more species listed as threatened or endangered than any other region in the continental United States (*City of San Diego 1998*). The habitats in San Diego Bay alone support four federally listed endangered species, including the light-footed clapper rail, California least tern, brown pelican, and salt marsh bird's beak, three species listed as threatened, including the western snowy plover, Pacific green turtle, and California gnatcatcher, and one State listed endangered species, the Belding's savannah sparrow (*Passerculus sandwichensis beldingi*).

The San Diego Bay NWR benefits from being situated within the Southern California Bight, a distinct bioregion of California that includes the marine-coastal interface and extends inland to include the coastal wetlands and watersheds of southern California (Figure 3-6). The Bight's embayments, which include San Diego Bay, and its marshes and estuaries, are among the most productive habitats on the Pacific Coast. Unfortunately, estimates by the Southern California Coastal Wetland Inventory prepared by the California Coastal Conservancy indicate that less than 30 percent of the wetlands that once occurred within the Bight are still present today. As a result, the coastal habitats that do remain within the Bight are of regional significance because of the many wetland dependent organisms that are supported by these habitats.

The remaining natural wetlands included within the Sweetwater Marsh and South San Diego Bay Units represent two of the 23 coastal wetland systems remaining in San Diego County. More importantly, much of what remains of San Diego Bay's historical shallow subtidal, intertidal mudflat, and salt marsh habitats are preserved within the San Diego Bay NWR. In addition to these natural wetland habitats, the Refuge also includes a system of salt ponds and associated levees that provide roosting, foraging, and/or nesting opportunities for tens of thousands of migratory birds. As such, the Refuge protects habitats essential to the migratory birds of the Pacific Flyway (refer to Figure 3-6). In recognition of the importance of the foraging and nesting habitats protected within this Refuge and the specific species these habitats support, the south bay has been designated a Western Hemisphere Shorebird Reserve Network Site and each Unit is recognized as a Globally Important Bird Area by the American Bird Conservancy.

These natural wetland systems, particularly those included in the Sweetwater Marsh Unit, are also of regional significance because they are permanently open to tidal flushing. As a result, they support a high diversity of salt marsh plant species, including a number of low marsh species, such as cordgrass, annual pickleweed (*Salicornia bigelovii*), and saltwort (*Batis maritima*), which are generally absent from nontidal wetland systems. Today, approximately half of the coastal wetlands in the Southern California Bight are either frequently closed or always closed to tidal influence, primarily as a result of human disturbance. Such closures reduce the availability of nutrients and dramatically alter salinities in the water column and within the soil. Many salt marsh plant species cannot tolerate these conditions, which over time have resulted in reduced native plant species diversity and lower habitat values.

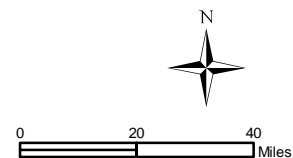
Although now included within the San Diego Bay NWR, the majority of the bay's remaining wetlands have not escaped the impacts of human disturbance. On the Sweetwater Marsh Unit, wetland habitat values have been reduced by decreases in the volume of tidal and freshwater flows that historically entered the marsh complex, as well as changes in historical tidal circulation patterns. In addition, the salt ponds within the South



**Figure 3-6 - Regional Setting**  
**Location of the San Diego Bay NWR within the Southern California Bight<sup>1</sup> and the Pacific Flyway**

★ San Diego Bay National Wildlife Refuge

1. The Southern California Bight extends from Point Conception in Southern California to Cabo Colonett and Bahia de San Quintin in Baja California, Mexico.



San Diego Bay Unit receive no benefit from tidal flushing. As a result, there are opportunities available at both of these Refuge Units for improving habitat values for wildlife, and avian species in particular.

### **Applicable Recovery Plans**

The Service has prepared recovery plans for the federally listed species that occur within these Refuge Units. These recovery plans, which include the California Brown Pelican Recovery Plan (*USFWS 1983*), California Least Tern Recovery Plan (*USFWS 1985a*), Salt Marsh Bird's Beak (*Cordylanthus maritimus maritimus*) Recovery Plan (*USFWS 1985b*), Light-footed Clapper Rail Recovery Plan (*USFWS 1985c*), Recovery Plan for U.S. Pacific Populations of the Green Turtle (*Chelonia mydas*) (*National Marine Fisheries Service and USFWS 1998*) and the draft Western Snowy Plover (*Charadrius alexandrinus nivosus*) Pacific Coast Population Recovery Plan (*USFWS 2001*), are intended to serve as guidance documents for agencies, landowners, and the public. Each plan includes recommendations for actions considered necessary to satisfy the biological needs and assure the recovery of the listed species. These plans also emphasize opportunities for improved management of listed species on Federal and State lands. Recommended actions generally include protection, enhancement, and restoration of those habitats deemed important for recovery, monitoring, research, and public outreach.

The recommendations provided in the recovery plans for the listed species have been considered during the development of the CCP. Recommendations specific to the Sweetwater Marsh and/or South San Diego Bay Units are reflected in the goals, objectives, and strategies developed for each Refuge Unit.

### **Ecoregion Planning**

The San Diego Bay NWR is included within the Southern California Ecoregion, as designated by the Service. The Southern California Ecoregion is defined by all watersheds (including coastal wetlands and off-shore islands) from Monterey Bay south to the US/Mexico border and east to the Arizona and Nevada state lines. This ecoregion includes distinct coastal and desert components, a rare combination of diverse habitat types, and one of the nation's highest concentrations of threatened and endangered species. The purpose of establishing these ecoregions is to develop and implement goals, priorities, objectives, and actions that will ensure an "ecosystem approach" to fish and wildlife conservation (*USFWS 1995*).

### **Shorebird Conservation Planning**

The San Diego Bay NWR is also located within the Southern Pacific Shorebird Planning Region, as defined by the U.S. Shorebird Conservation Plan (*Brown et. al. 2001*). The Southern Pacific Region is an important wintering area for shorebirds that breed in the arctic and temperate zones, but is also important during migration, particularly for arctic-breeding species. There are also important breeding populations in the region. The major regional goal of the U.S. Shorebird Conservation Plan is "to ensure that adequate quantity and quality of habitat is identified and maintained to support the different shorebirds that breed in, winter in, and migrate through each region." The Southern Pacific Shorebird Conservation Plan (*Hickey et al. 2003*) includes several conservation priorities that are relevant to the San Diego Bay NWR. These include increasing the breeding population of the western snowy plover to 2,750 breeding adults; increasing or maintaining the breeding populations of the black-necked stilt, American avocet, and killdeer by restoring, enhancing, or creating nesting habitat; and increasing migratory and wintering populations



of all key shorebird species in the region using various protection, restoration, enhancement, and management strategies. The Plan identifies tidal flats as the most important shorebird habitat within the coastal embayments of California. The San Diego Bay NWR includes the largest remaining area of tidal mudflat habitat and the largest remaining area of coastal salt marsh habitat within San Diego Bay; therefore, the Regional Shorebird Plan's habitat goals for tidal wetlands are relevant to this Refuge. These goals include restoring tidal flats and marshes on the southern California coast; enhancing tidal action in existing wetlands as needed; and limiting human disturbance to shorebirds in all seasons. The Plan also includes goals for managed wetlands, which call for improving the value of existing managed wetlands to benefit shorebirds; restoring additional wetlands to support shorebirds; retaining and managing a sufficient amount of salt ponds and other shallow open water habitat to support shorebird populations.

San Diego Bay NWR provides breeding, wintering, and/or stopover habitat for most of the shorebirds identified in the Plan as having primary importance within the region. Of the ten species for which coastal habitats in the Southern Pacific Region are especially important, the black-bellied plover (*Pluvialis squatarola*), western snowy plover, semipalmated plover (*Charadrius semipalmatus*), willet (*Catoptrophorus semipalmatus*), marbled godwit (*Limosa fedoa*), black turnstone (*Arenaria melanocephala*), short-billed dowitcher (*Limnodromus griseus*), and red-necked phalarope (*Phalaropus lobatus*) are supported on this Refuge.

### **Waterbird Conservation**

The North American Waterbird Conservation Plan (*Kushlan et al 2002*) provides a continental-scale framework for the conservation and management of 210 species of waterbirds, including seabirds, coastal waterbirds, wading birds, and marshbirds. Eighty percent of the species addressed in this plan are colonial nesters and of this group, approximately one third of the species are considered to be at risk of serious population loss. Many non-colonial waterbirds are also considered at risk. Threats to these species include habitat loss (e.g., destruction of coastal wetlands), introduced predators and invasive species, pollutants, human disturbance, and conflicts among species. The habitat goal for this plan is "to protect, restore, and manage sufficient high quality habitat and key sites for waterbirds throughout the year to meet species and population goals." Brandt's cormorant (*Phalacrocorax penicillatus*), black skimmer, least tern, tricolored heron (*Egretta tricolor*), pelagic cormorant (*Phalacrocorax pelagicus*), and gull-billed tern, all known to occur on the Refuge, are identified as high concern species in the Plan.

### **National Strategy for Coastal Restoration**

The Estuary Restoration Act of 2002, signed into law in November 2000, establishes a strong Federal commitment to restore habitat in America's estuaries. The Act set a goal for restoring one million acres of estuarine habitat by 2010 by leveraging limited Federal resources with state and local funding. The Act makes restoring our nation's estuaries a national priority and authorizes funding for estuarine habitat restoration projects, to realize the priority of restoring habitat, strengthening local, regional, and national economies, and improving quality of life in coastal communities. A requirements of the Act is the development of an Estuary Habitat Restoration Strategy. To address this requirement, *A National Strategy to Restore Coastal and Estuarine Habitat* was issued in April 2002 by Restore America's Estuaries, a nonprofit organization, and the National Oceanic and Atmospheric Administration (NOAA).

The objectives of the *National Strategy* include: implementing habitat restoration projects; creating and maintaining public-private restoration partnerships; encouraging restoration planning and priority setting; applying the best appropriate restoration science and technology; evaluating and monitoring the effectiveness of restoration; increasing awareness of, support for, and being involved in restoration; and obtaining sufficient funding to implement these objectives. The National Strategy's Regional Analyses of Restoration Planning identifies a high need for restoring key habitats within coastal California and the Pacific Islands. These include estuarine habitats (e.g. tidal salt marsh and freshwater marsh), beaches and dunes, intertidal mudflats, and other wetlands.

During the development of the CCP, several of the actions presented in the National Strategy were considered including: evaluating potential habitat restoration projects based on regional priorities; addressing issues important to coastal communities and other stakeholders; and facilitating community and volunteer involvement in restoration planning. The CCP also proposes actions to increase public awareness of restoration efforts and identifies methods for involving the community in future restoration projects.

### **Marine Protected Areas**

Marine Protected Areas (MPAs) are defined by Section 2(a) of Executive Order 13158 as “any area of the marine environment that has been reserved by the Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part of all of the natural and cultural resources therein” (65 Federal Register 34909, May 26, 2000). The San Diego Bay NWR is included on the marine managed areas inventory, which will be used to form a pool of sites that may later be considered for the list of MPAs.

MPAs may be established by Federal, State, or local governments to protect marine habitats and natural and cultural resources from overexploitation, destructive uses, or other threats, or to conserve species, habitat, or biological diversity. They may also be created to provide valuable opportunities for recreation, enjoyment, and study.

### **California Wildlife: Conservation Challenges, California's Wildlife Action Plan**

The draft Wildlife Action Plan (California Department of Fish and Game 2006) identifies the species and habitats at greatest risk in California; describes the major stressors affecting wildlife and habitats; and presents statewide and regional conservation actions needed to restore and conserve ecosystems and wildlife populations. Conservation actions that apply to the management of the San Diego Bay NWR include: improve the implementation of the Natural Community Conservation Plans, in this case the San Diego Multiple Species Conservation Program; protect and restore coastal wetlands; control invasive species; protect sensitive species and important wildlife habitats; institute fire management practices to restore ecological integrity, while minimizing loss of property and life; and provide recreational opportunities compatible with wildlife habitat needs.

### **Regional Restoration Needs**

Evaluation of the various enhancement and restoration opportunities on the Sweetwater Marsh and South San Diego Bay Units was an important aspect of the CCP process. The process included an assessment of the types of habitats that historically occurred within the Refuge, the types of habitats needed to support threatened and endangered species in the South Bay, and the overall habitat needs and priorities for the region. The historic perspective provided above demonstrates the need for restoration due to the extensive loss of coastal wetland habitat throughout southern California. Restoration is needed not only

because coastal wetlands historically occurred within the boundaries of the Refuge, but also because of the regional need to provide appropriate habitat for coastal wetland dependent species, including fish, wildlife, and plants. In completing this evaluation, the analysis and recommendations of various regional habitat management plans were also considered including the Multiple Species Conservation Plan (*City of San Diego 1998*) and accompanying subarea plans (*City of San Diego 1997*, *City of Chula Vista 2003*) and the San Diego Bay Integrated Natural Resources Management Plan (*U.S. Navy 2000*).

Habitat enhancement and restoration would also benefit the threatened and endangered species supported in the South Bay. This is particularly true for the light-footed clapper rail, California least tern, and western snowy plover. The population of clapper rails in the South Bay is extremely small. During the 2000 census of light-footed clapper rails in California, only four pairs were detected within the Sweetwater Marsh Unit. This is down from 11 in 1996 and just one pair was detected in the South San Diego Bay Unit in 2001 and 2002. Throughout their range, the estimated population of this species in 2004 was about 350 pairs (*Collins pers. comm.*). Although pairs have been detected in 15 coastal wetlands in southern California, the majority of these birds are concentrated in two locations, Upper Newport Bay and the Tijuana Slough NWR. Restoration of habitat and increased management are considered essential if the smaller subpopulations are to survive (*California Department of Fish and Game 1996*).

One of the primary reasons that the California least tern is endangered is reduction in available suitable nesting areas along beaches and sandy area near estuaries. Today, least tern nesting is confined to a relatively fixed number of sites, including the D Street Fill on the Sweetwater Marsh Unit and the pond levees of the South San Diego Bay Unit. Productivity of the existing nesting sites must be improved in order to continue least tern recovery and increase the San Diego Bay contribution to this recovery (*USFWS 2002*). The levees around the salt ponds provide an opportunity to create additional nesting areas for the least tern. Such improvements would also benefit the western snowy plover, which has similar nesting requirements.

### **3.4.2 Habitat and Vegetation**

#### **3.4.2.1 Summary of Vegetation Communities within the San Diego Bay NWR**

The San Diego Bay NWR includes a variety of natural and disturbed habitat types ranging from sensitive coastal wetlands to disturbed uplands to commercial salt ponds. There are many opportunities for enhancing the habitat quality within several of the native habitat areas. Additionally, the Refuge provides numerous opportunities for restoring the significant native coastal wetland and upland habitats that once dominated the areas around San Diego Bay.

Terrestrial vegetation community descriptions provided in this section are based on Barbour and Major (1988). The salt marsh descriptions parallel those described by Zedler et al. (1992) and other aquatic habitat descriptions come from the San Diego Bay INRMP (U. S. Navy 2000). The habitats supported within the Refuge are presented below by Refuge Unit.

#### **Sweetwater Marsh Unit**

The various habitats present within the Sweetwater Marsh Unit were determined based on information provided by in-field observations and aerial photographs. The results of this analysis are provided in Figure 3-7. The approximate acreage of each habitat type is presented in Table 3-5.



**Figure 3-7**  
**Habitats of Sweetwater Marsh Unit**

Source: James Thiede, Local Agency Partnership 2000 (2 ft imagery) 1

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**Table 3-5**  
**Summary of the Habitat Types Occurring on the Sweetwater Marsh Unit**

Habitat Type	Approximate Acres
Artificial Tidal Creek	0.5
Brackish Marsh	1.5
Coastal Sage Scrub	1.0
Coastal Sage Scrub (disturbed)	31.5
Developed/Fill	11.5
Exotic Shrubland	2.0
Fill w/ dune and scrub vegetation	56.5
Maritime Succulent Scrub	3.5
Mudflat	3.5
Nonnative Annuals	3.0
Open Water	1.5
Salt Marsh	184.0
Salt Pan/Salt Flat	7.0
Tidal Creek	9.0

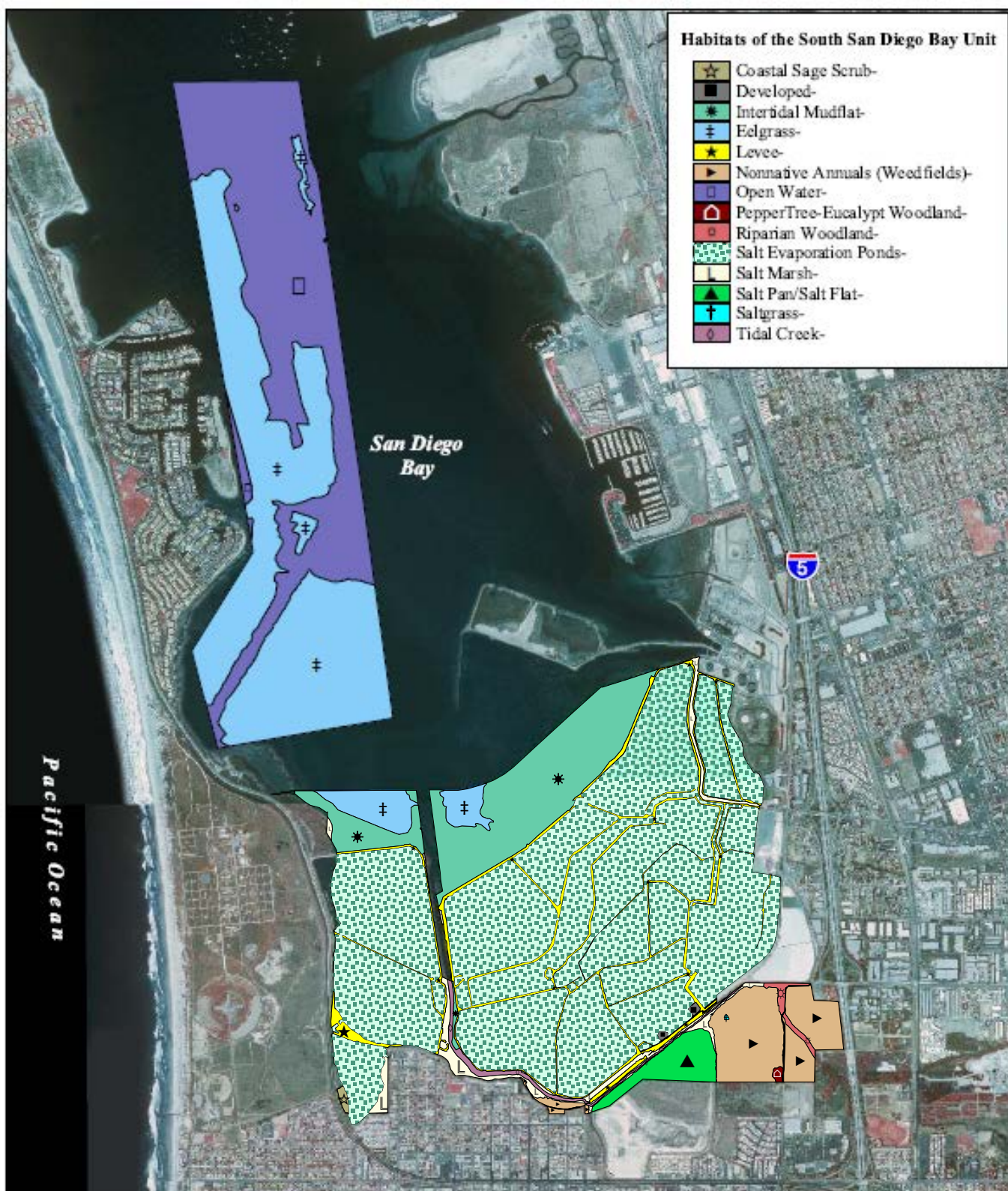
**South San Diego Bay Unit**

The approximate acreage of each habitat type identified within the 2,300-acre current management boundary of the South San Diego Bay Unit is presented in Table 3-6 and illustrated in Figure 3-8.

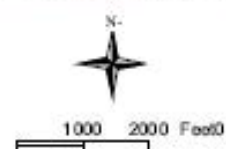
**Table 3-6**  
**Summary of the Habitat Types Occurring on the South San Diego Bay Unit**

Habitat Type	Approximate Acres
Coastal Sage Scrub	2.0
Developed	2.0
Eel Grass	440.0
Intertidal Mudflat	220.0
Levee	85.0
Nonnative Annuals	98.0
Open Water	410.0
Pepper Tree/Eucalyptus Woodland	1.0
Riparian Woodland	5.0
Road	2.0
Salt Ponds	964.0
Salt Marsh	30.0
Salt Pan/Salt Flat	30.0
Tidal Creek	11.0





**Figure 3-8**  
**Existing Habitats of the South San Diego Bay Unit**



Source: James Thiede, Merkel & Associates, Inc., Local Agency Partnership 200 (2 ft imagery)0

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### 3.4.2.2 Biological Resources

The following text summarizes the predominant habitat types within the Sweetwater Marsh and South San Diego Bay Units and discusses the various organisms that are supported by each habitat type. Much of this information comes from the San Diego Bay Integrated Natural Resources Management Plan (INRMP), prepared by the U.S. Navy and the Port in 2000 with input from a variety of other entities, including the Service, NOAA Fisheries, non-governmental organizations, and scientific advisors. Refer to the INRMP (*U.S. Navy 2000*) for a more detailed discussion of these habitats, particularly the habitats in the open waters of the bay.

#### **Open Water (San Diego Bay)**

This habitat type applies primarily to the South San Diego Bay Unit; little open water habitat occurs within the boundaries of the Sweetwater Marsh Unit.

#### **Moderately Deep Subtidal**

Moderately deep subtidal habitat, which occurs between the depths of -12 feet and -20 feet MLLW, extends from the approximate lower depth of most eelgrass to the approximate edge of the shipping channels in the bay. The only area within the South San Diego Bay Unit where moderately deep subtidal habitat occurs is at the upper end of the Emory Cove channel, near the northeastern edge of the South San Diego Bay Unit. Within the South Bay, this habitat generally represents areas that have been dredged in the past and have the potential for future restoration to shallow subtidal habitat.

Fish that dominate this habitat include round stingray (*Urolophus halleri*), spotted sand bass (*Paralabrax maculatofasciatus*), California halibut (*Paralichthys californicus*), and barred sand bass (*Paralabrax nebulifer*). This habitat also provides resting areas for bottom feeding diving birds, particularly rafting surf scoter, lesser scaup (*Aythya affinis*), greater scaup (*Aythya marila*), and bufflehead (*Bucephala albeola*) and feeding areas for plunge divers, such as terns and California brown pelicans.

#### **Shallow Subtidal**

The majority of the open waters of the South San Diego Bay Unit are classified as shallow subtidal habitat. This habitat is defined as continually submerged, shallow water habitat that extends from -2.2 feet to -12 feet MLLW. In San Diego Bay, shallow subtidal habitat supports an abundance of fish, and bird abundance and diversity is higher in this habitat than in any other subtidal habitats in the bay (*U.S. Navy 2000*).

From about the Coronado Cays south, the open bay consists almost exclusively of shallow subtidal habitat. This habitat includes both unvegetated, soft bottom areas and areas vegetated with eelgrass (*Zostera marina*). The unstable, soft bottoms of the unvegetated areas shift in response to tides, wind, waves, currents, and various human and biological activities. It is difficult for plants and animals to become anchored to the substrate in this area; therefore, they tend to burrow into the substrate rather than attach to it. An important component of these unvegetated areas is the presence of extensive mats of living algal material formed primarily by the red alga *Gracilaria verrucosa*. These mats, which also include the red algae *Hypnea valentiae* and *Griffithsia pacifica*, provide cover for many species of invertebrates and fishes and appear to serve as a food source for some invertebrates (*U.S. Navy 2000*).

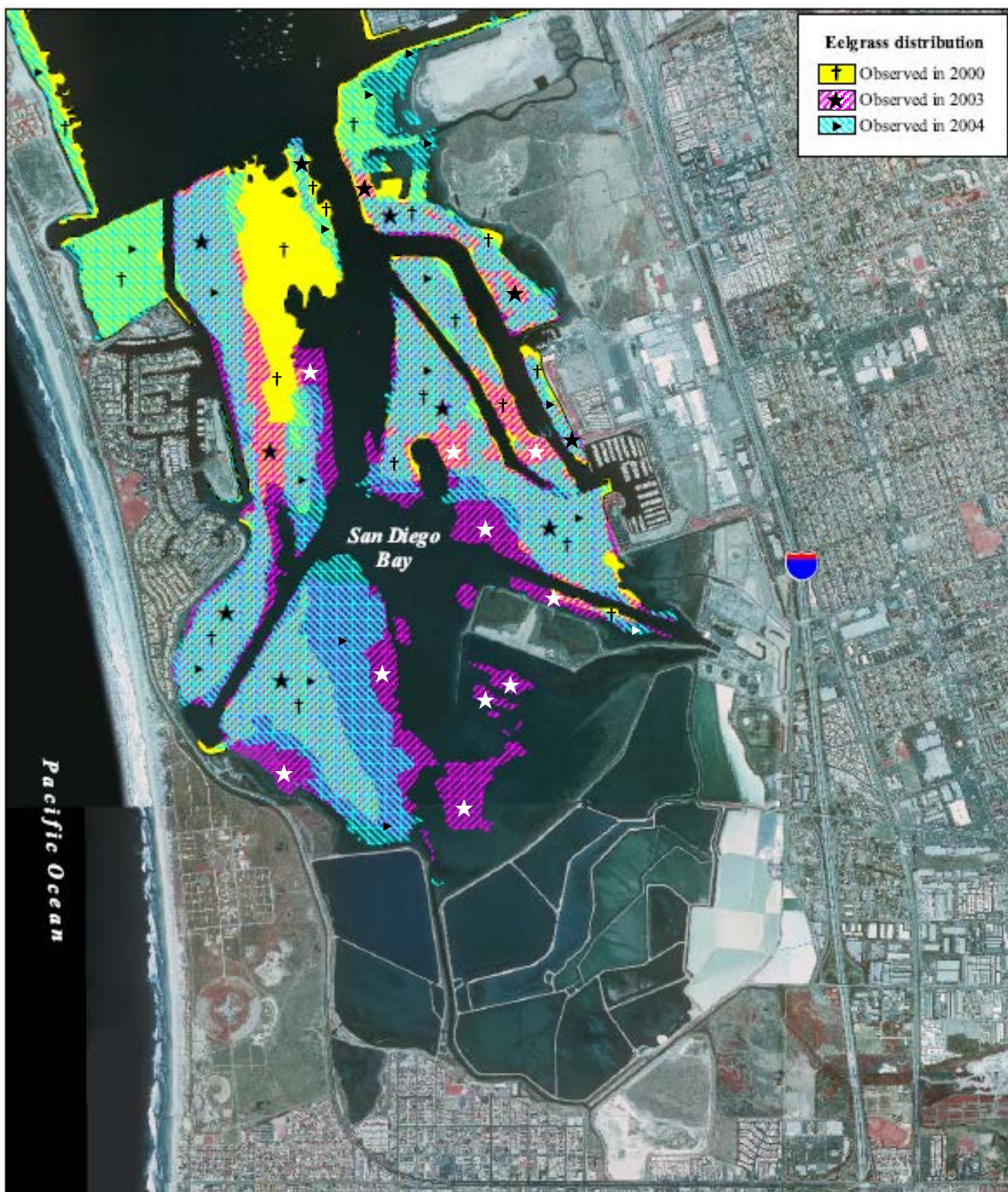


The vegetated areas of the shallow subtidal habitat are dominated by eelgrass, a flowering plant that has adapted to growing submerged in shallow, saline environments, such as bays and estuaries within the earth's temperate regions (*Goals Project 2000*). Where eelgrass occurs, the substrate at the bottom of the bay is stabilized by the roots and rhizomes produced by the eelgrass. In addition, the eelgrass leaves slow the current and reduce the effects of wind and wave motion, allowing sediment and organic material to drop out and accumulate on the bottom (*U.S. Navy 2000*).

Eelgrass beds provide highly productive microhabitats for a wide variety of invertebrates and small fish. The eelgrass blades provide shelter for small fish, while small plants (epiphytes) and small animals (epizoites) use the leaves as a substrate for attachment. Other burrowing animals live in the sediment bed that has been stabilized by the eelgrass (*U.S. Navy 2000*).

Eelgrass provides food both directly and indirectly to a wide array of organisms. It can enter the food web as detritus, be eaten by fish that are sometimes eaten by fish-eating birds, or be consumed directly by birds, such as black brant, gadwall (*Anas strepera*), and northern pintail (*Anas acuta*). The bay's small population of Pacific green sea turtles also relies on eelgrass as an important food source. The density and biomass of the South Bay's eelgrass beds can vary widely from one season to another and are affected by water depth, sediment grain size, nutrients, light levels, temperature, salinity, and water quality. The extent of eelgrass beds within the South Bay has been studied several times between 1993 and 2003. The most recent survey, conducted by Merkel & Associates in May 2003, indicated that eelgrass has continued to expand throughout the South Bay since 1993. This expansion, which is illustrated in Figure 3-9, is likely the result of continuing improvements in water quality within the South Bay (*Tenera Environmental and Merkel & Associates 2004*). The data from the 2003 survey indicated that eelgrass was widespread within the western half of the southern end of the bed, generally from the southern end of the Coronado Cays on the north and the Otay River channel on the east. With the exception of one bed located near the mouth of the Otay River Channel, which covered 76 to 100 percent of the bottom cover, the majority of the eelgrass beds to the west of the Otay River Channel covered approximately 26 to 50 percent of the bay floor. From the Otay River east, the shallow subtidal habitat only supported sparse, isolated patches of eelgrass covering less than 25 percent of the bottom. These isolated patches were not expected to persist through the summer months when water temperatures are much higher than they are in the spring, when the survey was conducted (*Tenera Environmental and Merkel & Associates 2004*).

The South Bay's shallow subtidal habitat is important to a variety of fish species. Between 1994 and 1999 Dr. Larry Allen of the Nearshore Marine Fish Research Program, California State University, Northridge conducted a five-year research project that provided a definitive assessment of the fish populations inhabiting San Diego Bay (*Allen 1999*). The results indicated that the most abundant species in the southern end of the bay included slough anchovy (*Anchoa delicatissima*), topsmelt (*Atherinops affinis*), arrow goby (*Clevelandia ios*), round stingray, northern anchovy (*Engraulis mordax*), and shiner surfperch (*Cymatogaster aggregata*). With respect to biomass, round stingrays, spotted sand bass, barred sand bass, and bat rays (*Myliobatis californicus*) were the dominant species in this area. Of these species, the slough anchovy, topsmelt, northern anchovy, and shiner surfperch represent important forage species for diving birds.



**Figure 3-9**  
**Eelgrass Distribution in South San Diego Bay**

Source: Merkel & Associates, Inc., San Diego Port Authority, f  
Local Agency Partnership 2000 (2 ft imagery) f

Allen also found that the South Bay provides significant habitat for a group of twelve species of fish that are indigenous to the bays and estuaries of the Southern California Bight (Table 3-7). According to Allen, the extensive shallow water habitat and eelgrass beds of the South Bay support “very high standing stocks of both fisheries species and of midwater, schooling fishes, such as northern anchovies, slough anchovies and topsmelt” (Allen 1999). These species, in turn, represent a major forage resource for predatory fish and avian species. In addition, Allen found that the warmer, hypersaline waters of South Bay offer shelter for a number of fish species commonly encountered further south in the Eastern Subtropical and Tropical Pacific. Such species include California halfbeaks (*Hyporhamphus rosae*), California needlefish (*Strongylura exilis*), Pacific seahorse (*Hippocampus ingens*), and red goatfish (*Pseudupeneus grandisquamis*). The presence of these species, referred to as southern “Panamic Province” fish species, make San Diego Bay “unique among all other southern California embayments” (Allen 1999). Other studies indicate that the South Bay may also function as an important nursery area for juvenile California halibut and young spotted and barred sand bass (U.S. Navy 2000).

Shallow subtidal habitat also provides foraging and resting habitat for thousands of migratory and resident birds, with waterbirds being more abundant near the shoreline. Bottom-feeding divers such as scoters and scaup, dabbling black brant, plunge divers such as terns, and the surface-foraging black skimmer appear to prefer these waters over the other subtidal habitats in the bay (U.S. Navy 2000).

Table 3-7 Fish Species Indigenous to the Southern California Bight's Bays and Estuaries	
Scientific Name	Common Name
<i>Anchoa compressa</i>	Deepbody anchovy
<i>Anchoa delicatissima</i>	Slough anchovy
<i>Fundulus parvipinnis</i>	California killifish
<i>Clevelandia ios</i>	Arrow goby
<i>Gillichthys mirabilis</i>	Longjaw mudsucker
<i>Syngnathus leptorhynchus</i>	Bay pipefish
<i>Syngnathus auliscus</i>	Barred pipefish
<i>Ilypnus gilberti</i>	Cheekspot goby
<i>Mugil cephalus</i>	Striped mullet
<i>Paralabrax maculatofasciatus</i>	Spotted sand bass
<i>Hypsoblennius gentilis</i>	Bay blenny
<i>Quietula ycauda</i>	Shadow goby

Source: (Allen 1999)

### **Intertidal**

Intertidal habitat includes the area between the high and low tides (+7.8 feet to -2.2 feet MLLW) and is subject to varying degrees of tidal submergence. Both intertidal mudflat and coastal salt marsh are included in this habitat type.

The predominant habitat type within the Sweetwater Marsh Unit is intertidal. This habitat occurs within Paradise Marsh, the Connector Marsh, Sweetwater Marsh, and the F&G Street Marsh. There are four major areas of intertidal habitat within the approved acquisition boundary for the South San Diego Bay Unit. These include the J Street Marsh,

located just south of the Chula Vista Marina; the South Bay Biological Study area, located just north of Pond 11; the extensive mudflats located to the north of the salt works; and approximately 11,500 feet of the Otay River channel, roughly from river mouth near the northern end of Pond 11 to approximately 1,500 feet upstream of the confluence of Nestor Creek and the Otay River. An additional area of intertidal mudflat habitat consisting of roughly 200 acres is located to the west of the Sweetwater Marsh Unit, outside the approved boundary of the San Diego Bay NWR. This habitat is managed by the Port.

The results of Allen's 1999 study showed that 70 percent of all individual fish captured in San Diego Bay were juveniles. He concluded that this high proportion of juveniles in the catch underscored the significance of the bay, particularly the bay's intertidal habitat, as an important nursery area for a large number of fish species, including halibut and surf perch. The intertidal habitats of the Sweetwater Marsh Unit provide important foraging areas, as well as protection from predators, for various juvenile species, including estuarine species such as California killifish, longjaw mudsucker, topsmelt, and arrow goby (*U.S. Navy 2000*).

### **Intertidal Flats**

Intertidal flats include mudflats, sand flats, and salt flats. These flats occur between the highest high and lowest low tide zones, or generally between the lowest cordgrass and the highest eelgrass habitat areas, at approximately 3 to 0 feet MLLW in San Diego Bay. Within the Sweetwater Marsh Unit, intertidal mudflats occur along the margins of the historic Sweetwater River channel and the margins of the various tidal channels the wind through the Refuge's salt marsh habitat. Significant areas of intertidal mudflat habitat also occur immediately to the west of the Refuge boundary.

Several salt flats occur within Paradise Marsh, the largest in the northeast corner of the marsh. This area is inundated only during the higher high tides. These areas resemble mudflats, with a thin salty crust and little or no vegetation.

Within the South San Diego Bay Unit, intertidal mudflats are found to the south of the Chula Vista Marina, to the north of the salt ponds, and along the southwest margin of the bay. Pond 10A also functions as mudflat habitat because the water level in this primary pond is often so low that the muddy bottom of the pond is exposed and utilized for foraging and roosting by a number of shorebirds.

Intertidal flats can consist of various combinations of clay, silt, sand, shell fragments, and organic debris. The water levels on the flats are determined by the daily tidal cycles, which submerge or expose the surface approximately twice per day (*Goals Project 2000*). These mudflats contain abundant organic matter and microorganisms, but not at the level found in eelgrass beds or salt marsh habitat. Although generally thought of as unvegetated, mudflats often contain areas of microorganisms, including diatoms and blue-green algae, which provide food for various species of worms and other invertebrates. Seasonal growth of macroalgae, such as *Enteromorpha* sp., *Cladophora* sp., and sea lettuce (*Ulva* sp.), can also occur. The invertebrates found on these mudflats include organisms that feed on detritus and algae, as well as snails, crabs, and polychaete worms, that glean food from the mud substrate or capture prey in the shallow water.

Following the tides onto the mudflats are numerous bony fish species, sharks, and rays, all of which forage on the variety of organisms that live on the mudflats. Most of the fish observed can be found during the high tide; however, some fish remain on the mudflats



during low tide in shallow drainage channels. A few of these fish are year-round residents, while others, such as California halibut and California halfbeak are seasonal visitors that live on the tidal flats during juvenile life stages (*U.S. Navy 2000*). The presence of fish along the mudflats during high tide tends to attract various bird species including California least terns, black skimmers, and other tern species that forage for fish within the bay.

While larger fish move onto the mudflats during high tide, great numbers of shorebirds assemble on these same areas during low tide to forage on the many invertebrates available on the exposed flats. In addition to foraging, shorebirds also depend upon the mudflats for roosting and resting. Further, shorebirds represent a significant portion of the bird use on the mudflats during the nonbreeding period. The Southern Pacific Shorebird Conservation Plan (*Hickey et al. 2003*) states that intertidal flats are “the most important shorebird habitat within the coastal embayments of California.” The most extensive mudflats within the South Bay are those that lie to the north of the salt ponds. The Service observed tens of thousands of birds, representing 67 species, in this area during 1993 and 1994. The majority of the birds observed were shorebirds and seabirds (*USFWS 1999*). Additional information regarding shorebird use on these mudflats is provided in section 3.4.4.1

Beach hoppers, sand fleas, and a few insects also utilize the drier upper edges of the intertidal mudflat habitat. Of particular interest is a population of mudflat tiger beetles (*Cicindela trifasciata sigmoidia*) that were identified along the fringe of the mudflat and low marsh habitat at the southern edge of the D Street Fill within the Sweetwater Marsh Unit (*Merkel & Associates, Inc. 2000*).

### **Coastal Salt Marsh**

Coastal salt marsh is composed of salt tolerant vegetation and occurs in the upper intertidal zone above the mudflats and above MSL. It is within the range of regular (daily) to irregular (less than daily) tidal inundation and is exposed more than inundated. The region's semi-arid Mediterranean climate yields only limited rainfall; therefore tidal circulation is the most important water source for this habitat. The tides also carry necessary nutrients into this habitat (*Michael Brandman Associates, Inc. 1990*). In San Diego Bay, coastal salt marsh habitat occurs between approximately +7.8 feet to +2.3 feet MLLW (*U.S. Navy 2000*).

At lower elevations, salt marsh habitat overlaps with intertidal flats and is subject to regular inundation. At the higher elevations, tidal inundation may occur only during the highest spring tides. The vegetation types and patterns vary along the marsh plain as a result of these changes in condition. Vegetation patterns within the marsh plain are also influenced by other factors, such as salinity, temperature, nutrient levels, sediment characteristics, and past disturbance. The influence of these factors is apparent when comparing the appearance and plant species composition of the coastal salt marsh areas located within the South Bay. These variations can be attributed to past disturbance within the marsh itself, changes in historic tidal and seasonal freshwater circulation, and natural differences in the physical and topographic characteristics of the particular marsh. There are also visible similarities between the South Bay's marsh areas, most notably the similarities in the general distribution of specific plant species across the marsh plain. For instance, cordgrass, when present, occurs within the lower elevations of salt marsh habitat, while glasswort occurs at the upper elevations. The marshplain is often bisected by

estuarine channels and tidal creeks, which provide the pathways for tidal waters to enter the marsh. These channel and creek areas support a wide variety of organisms, including macroalgae, phytoplankton, invertebrates, fishes, and birds (Zedler *et al.* 1992). Although shorebirds use salt marsh to a lesser degree than tidal flats, the larger non-vegetated channels in salt marsh are used as foraging habitat by the same species that feed on tidal flats (Hickey *et al.* 2003). Additionally, the Southern Pacific Shorebird Conservation Plan (Hickey *et al.* 2003) indicates that some shorebird species such as the willet, least sandpiper, and long-billed dowitcher use salt marsh as diurnal and nocturnal roost sites “possibly to provide some protection from predators.”

Coastal salt marsh habitat is most often described in terms of elevational zones (i.e. low, middle, and high marsh); however, some argue that zones based primarily on elevation inaccurately describe the overall plant species composition of the marsh plain, which is influenced by a number of other variables beyond elevation (Zedler *et al.* 1999). Zedler suggests that the various habitat designations within Southern California salt marsh be described as cordgrass habitat, marshplain, and high marsh dominated by glasswort.

Regardless of how they are described, there are three distinctive zones or subtypes within coastal salt marsh habitat. These zones are described below using the more typical elevational zone description.

Low Marsh. In San Diego Bay, low marsh occurs at the upper edges of the bay’s intertidal mudflat habitat, along the tidally influenced portions of the Otay River, and within the lower marsh plain and along the tidal creeks of the Sweetwater Marsh Unit. The tidal range for cordgrass dominated low marsh in the South Bay is generally from +3.5 feet to +4.5 feet (+1.1 meters to +1.4 meters) MLLW. Other plant species typically classified as low marsh species include annual pickleweed and saltwort, which can also be found higher in the marsh plain. In addition, pickleweed, which occurs throughout much of the marsh plain, can also be found in all but the lowest elevations of the area defined as low marsh.

Middle Marsh. Middle marsh habitat, which is generally defined as occurring between approximately +6 feet and +5 feet (+1.8 meters and +1.5 meters) MLLW, is characterized by the presence of saltwort, pickleweed, estuary seablite (*Suaeda esteroa*), and arrow grass (*Triglochin concinna*) (U.S. Navy 2000). Powell and Collier (1998) also identified salt marsh dodder (*Cuscuta salina*), alkali heath (*Frankenia salina*) and Jaumea (*Jaumea carnosa*) within the middle marsh areas of Sweetwater Marsh.

High Marsh. High marsh, also referred to as upper salt marsh, can occur within the marsh plain on isolated areas of higher elevation, as well as along the upland edge of the marsh. The elevational range for this habitat in San Diego Bay is approximately +7.8 feet to +6 feet (+2.4 meters to +1.8 meters) MLLW. The high marsh in San Diego Bay is dominated by glasswort, but a variety of other plant species are also found in association with glasswort, such as the following species identified by Powell and Collier (1998) in Sweetwater Marsh: boxthorn (*Lycium californicum*), alkali weed (*Cressa truxillensis*), salt grass (*Distichlis spicata*), Coulter's Goldfields (*Lasthenia glabrata*), sea lavender (*Limonium californicum*), and shore grass (*Monanthochloe littoralis*). The Federally listed endangered plant, salt marsh bird’s beak, also occurs within portions of the high marsh at Sweetwater Marsh Unit.

Upland Transition. The highest elevations of the high marsh zone are often referred to as upland transition or upland transition marsh. This habitat zone is not considered a distinct

community; rather it represents a gradient between the upper marsh and the native upland habitats of coastal sage scrub and maritime succulent scrub (*U.S. Navy 2000*). Unfortunately, native upland, as is discussed in detail below, is extremely scarce around San Diego Bay, having been all but eliminated due to a century of agricultural, industrial, and port related activities. Where it persists, the width of the transition area is narrow and the presence of native plant species, particularly native upland species, is limited.

In the upland transition areas that still exist within the Sweetwater Marsh Unit, Powell and Collier (1998) identified the following native plant species: fiddleneck (*Amsinckia spectabilis*), coyote brush (*Baccharis pilularis*), beach evening primrose, and salt heliotrope (*Heliotropium curvassavicum*). In the lower end of this transitional zone, surveys conducted in the South Bay have identified the presence of glasswort, salt grass, shoregrass, alkali heath, and alkali weed. In the upper transition zone, Watson's saltbush (*Atriplex watsonii*), flat-top buckwheat, and California sagebrush have been identified (*U.S. Navy 2000*).

Two remnant stands of yerba reuma (*Frankenia palmeri*) occur on Gunpowder Point at the fringes of the salt marsh habitat (*Pacific Southwest Biological Services, Inc. 1990*). This is the only known location for yerba reuma in the United States. As a result of many years of human disturbance, the majority of the transitional zone within the Sweetwater Marsh Unit consists of non-native plant species. The most common species include Australian saltbrush (*Atriplex semibaccata*), hottentot fig, spiny sowthistle (*Sonchus asper*), sand-spurreys (*Spergularia* spp.), ripgut brome (*Bromus diandrus*), soft chess (*Bromus mollis*), red brome (*Bromus rubens*), chrysanthemum, and wild radish (*Raphanus sativus*) (*Pacific Southwest Biological Services, Inc. 1990*) (Powell and Collier 1998) (*U.S. Navy 2000*).

Today, the largest remaining salt marsh habitat in San Diego Bay is preserved within the Sweetwater Marsh Unit. The other areas of salt marsh habitat within the South Bay as described in the INRMP (*U. S. Navy 2000*) are listed in Table 3-8.

Table 3-8 Remaining Salt Marshes in the South Bay		
Salt Marsh <sup>1</sup>	Acreage	Inclusion in a NWR
Sweetwater Marsh (including the historic river channel)	121 acres	Sweetwater Marsh Unit
Paradise Marsh	44 acres	Sweetwater Marsh Unit
Marisma de Nacion (excavated from the D Street Fill)	27 acres	Sweetwater Marsh Unit
Connector Marsh (constructed to provide a hydrologic link between Paradise Marsh and Sweetwater Marsh)	17 acres	Sweetwater Marsh Unit
E Street Marsh (located southeast of Gunpowder Point)	27 acres	Sweetwater Marsh Unit
F&G Street Marsh	25 acres	Sweetwater Marsh Unit
J Street Marsh	25 acres	Not at present <sup>2</sup>
Chula Vista Wildlife Reserve (mitigation site created using dredge spoils to raise the site to elevations capable of supporting intertidal habitat)	32 acres	Not at present <sup>2</sup>
South End of Emory Cove (including the South Bay Biological Study Area)	27 acres	Not at present <sup>2</sup>
<b>TOTAL SALT MARSH ACREAGE IN SOUTH BAY</b>	<b>345 acres</b>	

<sup>1</sup> The locations of these salt marsh areas are indicated on either Figure 1-3 or Figure 1-6.

<sup>2</sup> These areas are currently included within the approved acquisition boundary for the South San Diego Bay Unit, but are not within the current Refuge management boundary.



Although no large areas of coastal salt marsh habitat are located within the current management boundary of the South San Diego Bay Unit, there are several significant linear areas that support this habitat. These areas include the narrow bands of salt marsh that occur on the slopes of some of the salt pond levees within the salt works, along the tidally influenced portions of a small drainage creek that extends between Ponds 15 and 28 (refer to Figure 2-6), along both sides of the Otay River channel from the mouth of the river near Ponds 11 and 12 to approximately 500 feet upstream of the river mouth, and into the southern branch of Nestor Creek. The outer levee of Pond 11 supports a variety of salt marsh plants, including pickleweed, annual pickleweed, glasswort, saltwort, sea lavender, alkali heath, estuary seablite, and shore grass (*Collins pers. comm.*). Cordgrass also occurs at the upper edges of the mudflat along some of the outer levees, along the edges of the drainage creek that flows between Ponds 15 and 28, and along the edges of the lower reach of the Otay River. Pickleweed-dominated salt marsh habitat occurs along outer slopes of the Otay River channel, particularly to the east of the railroad bridge. This area of high marsh also includes saltwort, sea lavender, boxthorn, and alkali heath.

The salt marsh habitat along the tidal channels and creeks within the Sweetwater Marsh Unit supports a variety of marine fish species that utilize these areas as nursery grounds. Within this Refuge Unit, the most abundant fish species include topsmelt, arrow goby, California killifish, and longjaw mudsucker. In addition, young round stingray and California halibut utilize this habitat for foraging and cover (*U.S. Navy 2000*). A variety of birds also utilize these tidal channels and creek for foraging; some feed on fish while others feed on invertebrates. Among them are the black skimmer, California least tern, great blue heron (*Ardea herodias wardi*), light-footed clapper rail, and belted kingfisher (*Ceryle alcyon*).

The salt marsh habitat on the Refuge also supports a diverse and abundant community of invertebrates. Comprehensive sampling of the invertebrates inhabiting the South Bay's coastal salt marshes has not been conducted to date; however, various assessments of specific areas within the bay provide some indication of the types of invertebrates expected to occur. For example, Scatolini and Zedler (1996) conducted an assessment of epibenthic (living on the bottom) invertebrates in natural and constructed coastal salt marsh habitat within the Sweetwater Marsh Unit. During this assessment, 45 species of invertebrates were collected in the study area, of which seven dominant invertebrates were identified. These included small dipteran larvae, *Pericoma* sp., a capitellid polychaete, an isopod, *Ligia occidentalis*, the amphipod, *Traskorchestia traskiana*, the mollusk, *Assiminea californica*, a species of biting midge, *Chuicoides* sp., and the yellow shore crab (*Hemigrapsus oregonensis*). Some of the more visible species of invertebrates in the Bay's salt marsh habitat include California horn snails (*Cerithidea californica*), fiddler crabs (*Uca crenulata*), and yellow shore crabs (*Hemigrapsus oregonensis*). Deposits of shells and active siphon jets within the marshes indicate an abundance of resident bivalves; the outer casings of marine polychaetes are also plentiful in this habitat (*Pacific Southwest Biological Services, Inc. 1990*).

Southern coastal salt marsh also supports a number of salt marsh dependent insect species, such as salt marsh water boatman (*Trichocorixia reticulata*), true flies (*Diptera* spp.), salt-marsh mosquitoes (*Aedes taeniorhynchus* and *A. squamiger*), tiger beetles of the genus *Cicindela*, and salt marsh skipper (*Panoquina errans*) (Zedler 1982). A comprehensive survey for insects in the South Bay has never been conducted; therefore, only limited information is currently available regarding species abundance and diversity.

The majority of the field investigations that have been completed have focused on determining the presence or absence of several special status insect species. Investigations conducted by Merkel & Associates, Inc. (2000) identified the following coastal salt marsh insects in and around the Sweetwater Marsh Unit: Gabb's tiger beetle (*Cicindela gabbii*), sand dune tiger beetle (*Cicindela latesignata latesignata*), haemorrhagic tiger beetle (*Cicindela haemorrhagica haemorrhagica*) and wandering skipper (*Panoquina panoquinoides errans*). The tiger beetle species were generally found in areas of hard-packed mudflat or salt flat interspersed with pickleweed, while the wandering skipper was associated with saltgrass located in high salt marsh habitat of the Sweetwater Marsh Unit.

Coastal salt marsh habitat within Sweetwater Marsh Unit and along the edges of the South San Diego Bay Unit provides nesting, foraging, and high-water refuge areas for many species of birds. Some notable species include the federally listed endangered light-footed clapper rail and the State endangered Belding's savannah sparrow. The clapper rail depends almost entirely on salt marsh habitat, and in particular dense patches of cordgrass, for feeding, resting, and nesting. Belding's savannah sparrows are found throughout the coastal salt marsh areas of the Sweetwater Marsh Unit and along the salt marsh vegetated edges of the salt works levees within the South San Diego Bay Unit. Savannah sparrows nest in patches of pickleweed and boxthorn and forage within salt marsh and intertidal mudflat habitat. This habitat also provides year-round foraging habitat for resident shorebirds, waders, and a variety of birds of prey, including northern harrier (*Circus cyaneus hudsonius*), osprey (*Pandion haliaetus carolinensis*), and an occasional peregrine falcon (*Falco peregrinus*). Other bird species characteristic of the South Bay's coastal salt marsh habitat include the great blue heron, great egret (*Ardea alba egretta*), black-crown night heron (*Nycticorax nycticorax hoactli*), willet, marbled godwit, and long-billed curlew .

### **Solar Salt Evaporation Ponds**

Although not considered a natural habitat, the salt evaporation ponds located within the South San Diego Bay Unit provide relatively isolated nesting and resting habitat for a wide range of avian species, as well as some unique foraging habitat for several species of migratory birds.

Solar salt production has occurred in south San Diego Bay for over 100 years, although early in the 1900s the system of salt ponds was somewhat smaller than it is today. These salt ponds provide an important stopover point for numerous species of migratory and wintering birds, as described later in Section 3.4.4.1. In addition, the salt pond levees provide important nesting habitat for seven species of colonial seabirds (refer to Section 3.4.4.1 for details).

The salt works includes approximately 1,068 acres of diked salt evaporation ponds and about 100 acres of associated levees. Although the ponds and levees are currently maintained to facilitate the commercial production of salt through a solar salt evaporation process, the Refuge Special Use Permit that allows this operation to occur on the Refuge includes various conditions to ensure the protection of the migratory birds that utilize the site. Of the 32 ponds used in the current operation, 26 are included within the Refuge boundary (refer to Figure 2-6). The remaining ponds are leased to the salt operator by other parties.

The salt ponds consist of shallow, open water cells with different salinity levels. As the water flows through the pond system, the ponds become more saline until near the end of the process, sodium chloride and other salts precipitate out and either form crystals or stay in a heavy brine solution. These products are then harvested, processed, and sold for industrial, commercial, and residential uses. The salt making process is described in greater detail in Appendix F. Briefly, the ponds are divided into four categories based on their salinity levels with the lower salinity ponds referred to as primary ponds, followed by secondary ponds, pickling ponds, and crystallizer ponds, which have the highest salinity levels. The range of salinity levels in each pond within the Refuge, as well as the pond acreages are provided in Table 3-9.

Table 3-9 Salinity Range and Approximate Acreage for Each Salt Pond Within the Refuge			
Pond Number	Salinity Range <sup>1</sup>		Pond Acreage <sup>2</sup>
	(°Be)	(ppt)	
10	2.5 - 4.5	11.5 - 37.5	<u>86</u>
10A	no data	no data	<u>35</u>
11	3.0 - 4.7	18.0 - 40.1	<u>112</u>
12	5.0 - 9.0	44.0 - 96.0	<u>101</u>
13	6.0 - 9.5	57 - 102.5	<u>67</u>
14	6.8 - 11	67.4 - 122	<u>45</u>
15	7.1 - 11.5	71.3 - 128.5	<u>90</u>
20	7.5 - 15	76.5 - 174	<u>35</u>
21	7.5 - 13.5	76.5 - 154.5	<u>28</u>
22	8.0 - 22.5	83 - 271.5	<u>64</u>
23	13 - 21	148 - 252	<u>72</u>
24	15.5 - 24.5	180.5 - 297.5	<u>58</u>
25	16 - 25	187 - 304	<u>21</u>
26	9.0 - 17.0	96.0 - 200	<u>23</u>
27	11.0 - 24.5	122 - 297.5	<u>57</u>
28	17.0 - 26	200 - 317	<u>32</u>
29	15 - 26	174 - 317	<u>20</u>
30	15.5 - 26	180.5 - 317	<u>15</u>
41	25.5 - 29	310 - 356	<u>18</u>
42	25.5 - 29	310 - 356	<u>9</u>
43	25.5 - 29	310 - 356	<u>5</u>
44	25.5 - 29	310 - 356	<u>18</u>
45	25.5 - 29	310 - 356	<u>17</u>
46	25.5 - 29	310 - 356	<u>6</u>
47	25.5 - 29	310 - 356	<u>13</u>
48	25.5 - 29	310 - 356	<u>13</u>
Total Acreage	--	--	<u>1,060</u>

<sup>1</sup> Measurements taken between 1996 and 2002

<sup>2</sup> Pond acreages include the water area and adjacent berms

Source: (South Bay Salt Works 2002)

The primary ponds (Ponds 10A and 10 through 15) have the lowest salinity levels within the system, with salinities increasing from west to east. The salinity levels in Ponds 10A, 10 and 11 are low enough to support the fish taken into the system through the tide gates. Once in the system, these fish cannot escape. Many are either eaten by opportunistic

herons, egrets, and terns or die due to the lack of an adequate prey source and increased salinity levels. As salinities increase in Ponds 12 through 15, fish can no longer survive.

Ponds 10 and 10A offer foraging and roosting habitat for a variety of shorebirds and other waterbirds, particularly when fluctuating water levels are low. In addition, the western primary ponds provide rafting habitat for an array of migrating waterfowl, such as lesser scaup. During avian surveys conducted in 1993/1994 by the Service, thousands of scaup were observed rafting in Pond 11 in February and March of 1993 (USFWS 1994).

The lowest salinity ponds within the primary system (Ponds 10, 10A, and 11) are believed to support some of the same invertebrates found in the adjacent bay; however, based on the data available, these organisms appear to be absent from the remainder of the system due to their inability to tolerate the system's hypersaline conditions. While observations of the upper primary and secondary salt ponds indicate the presence of brine shrimp, brine flies, and water boatmen beetles (*Trichocorixa reticulata*), a comprehensive survey to determine the diversity and abundance of these organisms within this system has not been conducted. Some sampling of species composition in the salt pond water column and pond sediments was conducted by Terp (1998) as part of her study of the role of salt evaporation ponds in South San Diego Bay in the habitat use patterns of wintering shorebirds. Water column samples taken from Ponds 12, 13, 15, 20, 22, 27, 28, 29, and several crystallizer ponds included the following organisms: brine shrimp; adult, pupal, and larval forms of brine fly; water boatman in adult and nymph form; topsmelt in larval form; a copepod; one individual mosquito, and 12 individual larval Coleoptera. Sediment samples had virtually no specimens and where specimens were found, they were only present in samples taken from Pond 30. From the samples taken in Pond 30, only four contained specimens, consisting of from two to 36 individuals of Ephydra larvae and pupae. Based on this limited sampling, brine shrimp and water boatman beetles were the most abundant in the secondary ponds, with Ponds 20 and the eastern portion of Pond 27 supporting the highest prey densities. Water boatman beetles were most prevalent in the primary ponds. Topsmelt larvae were only present in the primary ponds and at low densities.

Brine flies appear to be particularly abundant along the eastern edge of Ponds 15, within the tidal channel that flows between Ponds 15 and 28 and throughout the secondary pond system (Ponds 20 through 27), with the greatest concentration of flies occurring near the shoreline. The highest concentrations of brine shrimp appear to be in the secondary ponds. No studies have been conducted of aquatic invertebrate consumption by the birds that frequent the salt pond, however, observations of these same avian species at other highly saline water bodies provides some insight into the feeding preferences at the salt works. Specifically, observations of eared grebes at Mono Lake by Jehl (1988) indicate that invertebrate consumption by eared grebes shift between brine shrimp and brine flies, depending upon the availability of these species. When brine flies became particularly abundant, Jehl noted that eared grebes would concentrate their foraging efforts on brine flies, which have been shown to have a higher caloric value than brine shrimp (Herbst *et al.* 1983). Jehl's (1988) observations of Wilson's phalaropes (*Phalaropus tricolor*) indicate a diet of both brine shrimp and brine flies, with females feeding primarily on brine shrimp and males feeding primarily on brine flies. Studies conducted at Mono Lake, the Great Salt Lake, and Lake Abert, Oregon indicate that red-necked phalaropes visiting these lakes appear to feed predominantly on brine flies (Jehl 1986).

The secondary ponds include Ponds 20 through 27. The salinity range among these ponds is substantial, with lower levels (76.5 – 174 ppt) observed in Pond 20 and levels as high as 297.5 ppt. observed in Pond 27. During the 1993/1994 avian surveys, the highest total abundance of birds observed within the ponds was in Pond 23. Red-necked phalaropes and eared grebes were the two species most responsible for this high abundance. On July 24, 1993, over 3,000 red-necked phalaropes were observed within this pond (*Stadtlander and Konecny 1994*). The high numbers of phalaropes and grebes within the secondary ponds is attributed to the presence of large numbers of brine invertebrates.

Ponds 28, 29 and 30 make up the pickling ponds. During the 1993/1994 avian surveys (note: when recording bird presence at a particular pond during these surveys, observations included bird presence both within the open water area of the pond and the pond's associated levees), Pond 28 had the highest avian species diversity observed at these three ponds. In addition, this pond supported a relatively high abundance of birds when compared to the other ponds in the system. The majority of the birds observed were shorebirds, which appeared to use the pond as a roosting site during high tides when the mudflats adjacent to the salt ponds were inundated. The other two pickling ponds also appear to be used primarily for roosting. Some sandpiper foraging was observed in Pond 30.

The crystallizer ponds include Ponds 40 through 48 and 50 through 54, although the latter ponds are not included within the Refuge's acquisition boundary. All of the crystallizer ponds have extreme salinities and provide little in the way of direct habitat support for wildlife species. Avian species diversity was extremely low during the 1993/1994 surveys. Those species that were observed consisted primarily of shorebirds that utilized these ponds for roosting particularly during high tides.

Other organisms of interest living in the crystallizer ponds are classified within the Kingdom Archaea. Discovered in 1977, this group of organisms was initially described as Archaeobacteria, but biochemically and genetically, these organisms are very different from bacteria. Some archaeans, such as those found in the crystallizer ponds, can survive the desiccating effects of extremely saline waters. Archaeans may be the only organisms that can live in extreme habitats, such as thermal vents or hypersaline water. It is the Archaeans, such as *Halobacterium*, that give the salt ponds their reddish hue.

Studies of the invertebrate communities present within San Diego Bay's salt ponds have not yet been conducted; however, investigations conducted in the salt ponds of San Francisco Bay provide some general information regarding the types of invertebrate communities that might be present in the San Diego Bay salt ponds. Siegel and Bachand (2002) found from their review of the literature that the composition of the invertebrate communities in the San Francisco Bay salt ponds was generally influenced by salinity. Brine shrimp are found in ponds with salinities ranging from 70 to 200 ppt, but appear to have an optimum range of 90 to 150 ppt. Brine shrimp abundance in the San Francisco Bay salt ponds is at its highest during the warm summer months. In the San Diego Bay salt ponds, brine shrimp have been observed primarily in the secondary ponds, although they can also be found in the channel that connects the primary ponds to the secondary system. According to the literature, the salinity range for water boatmen is slightly lower, tolerating a range of about 20 to 170 ppt, with 35 to 80 ppt representing the peak reproductive range. Salinity tolerances vary for the different species of brine flies known to occur in salt ponds. Some species can tolerate up to 42 ppt, while others prefer significantly higher salinities (*Goals Project 2000*).

**Freshwater Wetlands**

Freshwater wetlands that occur within the Sweetwater Marsh and South San Diego Bay Units include brackish and freshwater marsh and disturbed southern willow scrub habitat. The freshwater marsh areas provide habitat for waterfowl, particularly dabbling ducks, herons and other waterbirds, while the willow shrub habitat supports a diversity of passerine birds, raptors, and small mammals.

**Freshwater/Brackish Marsh**

Freshwater marsh habitat occurs at the eastern end of Sweetwater Marsh. Soil moisture in this area is sufficient to support tall emergent vegetation, such as cattails and bulrushes. A number of exotic plant species have also invaded this area, including giant reed, castor bean, and tamarisk. These invasive pests provide low habitat value and are occasionally removed to make room for the reestablishment of native wetland species.

Within the South San Diego Bay Unit, freshwater marsh and brackish marsh occur within the Otay River channel. Brackish marsh occurs within the Otay River channel where tidal influence and freshwater influence converge (approximately 1,500 feet upstream of the convergence of Nestor Creek and the Otay River). Beyond this point, the habitat transitions into freshwater marsh dominated by cattail (*Typha domingensis*) and bulrush (*Scirpus robustus*).

**Riparian/Southern Willow Scrub**

Southern willow scrub habitat is limited to the South San Diego Bay Unit, where it occurs along the lower slopes of the Otay River channel. This habitat is highly disturbed, with many nonnative invasive plants present, particularly castor bean and giant reed. The native plants found within this habitat include arroyo willow (*Salix lasiolepis*), black willow (*Salix nigra*), western cottonwood (*Populus fremontii*), and mulefat (*Baccharis salicifolia*). This area provides substantial opportunity for habitat enhancement and wetland restoration.

**Uplands**

On those lands located adjacent to San Diego Bay, upland habitat generally occurs above the areas influenced by tidal action, or above +7.8 feet MLLW. The majority of the native upland habitats that once occurred around San Diego Bay have long since been replaced by development. The few undeveloped areas that remain, particularly in the South Bay, have been severely impacted by years of disturbance largely related to agricultural activities. As a result, undeveloped uplands around the bay consist primarily of nonnative grasslands and disturbed, weedy areas. Historically, the upland habitats around the bay are believed to have consisted of maritime succulent scrub, coastal sage scrub, and native grasslands.

**Maritime Succulent Scrub/Coastal Sage Scrub**

Despite the extent of habitat disturbance that has occurred within the upland areas of the Sweetwater Marsh Unit, remnants of maritime succulent scrub and coastal sage scrub habitat persist in several areas. Two patches of maritime succulent scrub can be observed on Gunpowder Point; one along the northeastern bluff and the other at the southeastern tip. A thin ribbon of this habitat also persists along the southern edge of Sweetwater Marsh where it abuts the northern edge of the Mid-Bayfront property. These areas are dominated by flat-top buckwheat, coast cholla (*Opuntia prolifera*), and California sagebrush. Coastal barrel cactus (*Ferocactus viridescens*) and snake cholla (*Opuntia parryi serpentina*) are also present in these habitats. Another acre of disturbed maritime

succulent shrub is located along a bluff at the northwestern end of Paradise Marsh. This habitat is dominated by California sage brush, lemonade berry, California encelia, and flat-top buckwheat. Ladies' fingers (*Dudleya edulis*), coast prickly pear, and coast cholla also occur here (*City of National City 1998*).

The portion of Gunpowder Point located to the west of the Nature Center supports disturbed coastal sage scrub, consisting primarily of broom baccharis (*Baccharis sarothroides*) and California sagebrush. Merkel & Associates, Inc. (2000) also identified the vegetation at the eastern end of the D Street Fill as disturbed coastal sage scrub. The most conspicuous species in this area is broom baccharis. Other dominant species include coyote brush, fragrant everlasting (*Gnaphalium canescens beneolens*), and coastal goldenbush (*Isocoma menziesii*). A narrow band of disturbed coastal sage scrub, characterized by broom baccharis, coastal goldenbush, and flat top buckwheat, is also present along the western edge of Paradise Marsh. Numerous non-native grasses and annuals also occupy this area (*City of National City 1998*).

Within the South San Diego Bay Unit, a band of disturbed maritime succulent scrub occurs in the vicinity of the railroad right-of-way between Ponds 22 and 20A. The habitat in this area is dominated by goldenbush and cholla. A variety of weedy species also are present including California everlasting (*Gnaphalium californicum*), stinging nettle (*Urtica holosericea*), horehound (*Marrubium vulgare*), broom baccharis, and salt bush (*Atriplex lentiformis*) (*Tierra Environmental Services 2001b*).

#### **Weedy, Nonnative Upland Habitat (Ruderal)**

The natural upland areas within the San Diego Bay NWR consist primarily of nonnative grasses and weedy annuals. Natural upland areas, such as those found on portions of Gunpowder Point, provide important opportunities for restoration of native upland habitat. Disturbed upland vegetation also occurs on several fill areas within the Refuge including the D Street Fill and the north end of the F&G Street Marsh.

On the South San Diego Bay Unit, the upland portions of the Otay River floodplain consist of weedy fields that support wild mustard (*Brassica* sp.), castor bean, garland chrysanthemum, and various non-native grasses (*Tierra Environmental Services 2001b*). Opportunities for restoring native upland habitat are available within this portion of the Refuge.

#### **Upland Fill Areas**

D Street Fill. Approximately 55.5 acres of the D Street Fill (refer to Figure 1-3) are located within the Sweetwater Marsh Unit. This fill was created in 1969 when dredge material was deposited here as a result of port developments to the north. Prior to the creation of this fill, this area supported native mudflat and salt marsh habitat associated with the Sweetwater River Wetlands Complex. Today, this disturbed upland area provides habitat for several species of ground nesting birds including California least terns, horned larks, and killdeer (refer to Section 3.4.4.1 for more information about nesting activity in this area). Western snowy plover nests have also been documented here in the past. This area also provides high tide roosting opportunities for various shorebirds and other waterbirds, and supports several sensitive plant species, various species of invertebrates, and some mammals, including the San Diego black-tailed jackrabbit (*Lepus californicus bennettii*).



During surveys conducted on the D Street Fill in 2000, Merkel & Associates describe the habitat on the northwestern half of the fill as disturbed coastal dune. This area, which was created using dredge materials from the bay, is regularly cleared of vegetation to prepare the area for annual seabird nesting. In the eastern portion of this fill area, where maintenance is more sporadic, a number of species have colonized the site; including beach-bur (*Ambrosia chamissonis*), Lindley's saltbush (*Atriplex lindleyi*), woolly lotus (*Lotus heermannii heermannii*), and beach evening primrose. Merkel (2000) also noted an abundance of woolly-heads in some areas.

Salt Pond Levees. The salt pond levees, which occupy approximately 100 acres within the South San Diego Bay Unit, consist primarily of unvegetated upland habitat. The lack of vegetation on many of the levee tops is the result of ongoing maintenance activities associated with the salt operation, as well as the high salinities that exist in the vicinity of the levees. These levees provide relatively secluded nesting habitat for thousands of breeding terns and black skimmers, as well as black-necked stilts, American avocets, and western snowy plovers (refer to Section 3.4.4.1 for detailed information about nesting activity in this area).

### **3.4.3 Plants**

#### **3.4.3.1 Introduction**

A comprehensive plant inventory has not been completed for the San Diego Bay NWR. Directed searches for rare plants are however periodically conducted on the Sweetwater Marsh Unit. The only endangered plant observed within the San Diego Bay NWR is the federally listed endangered salt marsh bird's beak, (discussed in detail in Section 3.4.5) and this species occurs only within Sweetwater Marsh Unit. Although common in some coastal marshes in Baja California, yerba reuma is only known to occur naturally in the United States within the Sweetwater Marsh Unit. The occurrence of other rare or sensitive plant species within the Refuge is discussed throughout Section 3.4.2.2.

#### **3.4.3.2 Exotic and Invasive Plant Species**

The exotic plant species that occur on this Refuge represent remnants of past human disturbance. Exotic trees and shrubs were planted as ornamental landscape specimens and do not appear to be spreading. On the Sweetwater Marsh Unit, these plants include California pepper tree (*Schinus molle*) and myoporum. On the South San Diego Bay Unit, several eucalyptus trees (*Eucalyptus* sp.) occur in the vicinity of a former home site and myoporum occurs in various locations within the Otay River floodplain.

Invasive plant species are those that spread into areas where they are not native, displacing the native species and/or changing species composition, community structure, or ecosystem function (Bossard et. al. 2000). Invasive plants represent a serious threat to biological diversity, directly impacting both native plants and wildlife. The freshwater habitats that occur on both of the Refuge Units are impacted by the presence of giant reed, castor bean, and tamarisk. Giant reed and tamarisk are of particular concern in the Otay River drainage because of the extent of infestation occurring within the Otay River watershed upstream of the Refuge. A study conducted for the City of Chula Vista (Merkel & Associates, Inc. and KTU+A, Inc. 2000) estimates that within the 145 square mile Otay River watershed, these two invasive species occupy a combined total of 410 acres (363.9 acres of tamarisk and 45.9 acres of giant reed). Because of the magnitude of this infestation, control of these invasive plants and the ultimate restoration of native riparian habitat will require a watershed-wide effort in order to be successful. Further, until the problem is

controlled upstream of the Refuge, continued invasion of the lower reaches of the Otay River is inevitable, despite routine localized control efforts on the part of the Service.

On the South San Diego Bay Unit, garland chrysanthemum invades the disturbed upland areas of Otay River floodplain, with fennel and tree tobacco present in significantly fewer numbers. Hottentot fig is also present near the Otay River channel and along the western edge of the western most salt ponds. On the Sweetwater Marsh Unit, these same species can be found along the edges of the marsh and at the D Street Fill. In addition, another Australian saltbush species, *Atriplex lindleyi*, has been observed near the eastern edge of the Sweetwater Marsh.

### **3.4.4 Wildlife**

#### **3.4.4.1 Birds**

##### **Migratory Birds**

Coastal wetlands and aquatic habitats of southern California provide essential foraging and resting areas for a multitude of birds migrating in the Pacific Flyway. San Diego Bay, historically one of the largest coastal wetland ecosystems of California's coast, has been highly modified with shipyards, marinas, military and civilian ship terminals, and other waterfront development. Presently, one of the last remaining strongholds supporting significant numbers of water dependent birds is located in South San Diego Bay, providing a vital link in the Pacific Flyway.

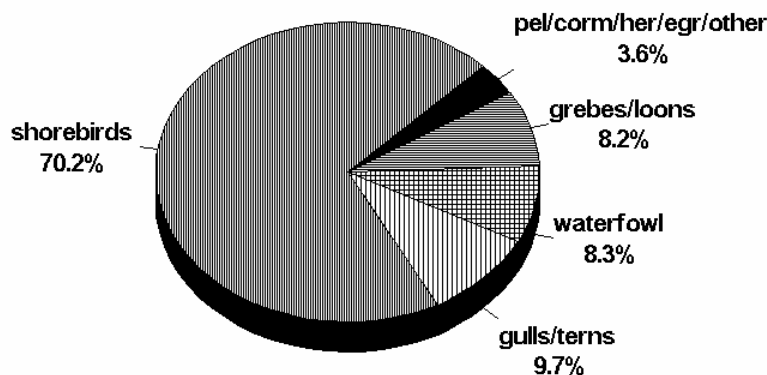
The open waters of the bay, including areas within the South San Diego Bay Unit, provide important wintering and migratory stopover habitat for many species of waterfowl. The most common of these species are the surf scoter, greater scaup, and lesser scaup. The intertidal mudflats and coastal salt marsh habitats of the Sweetwater Marsh and South San Diego Bay Units are also important wintering areas for many species of shorebirds, such as long-billed curlews, whimbrels, and red knots (*Calidris canutus*). The salt ponds and associated levees provide resting, foraging, and/or nesting habitat for an array of avian species, including Federal and State listed endangered species and various species identified by the Service as Birds of Conservation Concern.

While there have been some avifaunal surveys of portions of San Diego Bay and some of the migrating bird groups (Jurek 1974, Macdonald et al. 1990, and Page et al. 1992), the Service completed the first comprehensive surveys of the South Bay in 1993 and 1994.

##### **Migratory Bird Use of the Salt Ponds and Tidal Areas of South San Diego Bay**

In 1993 and 1994, the Service's Coastal Program (Stadtlander and Konecny 1994) conducted the first comprehensive evaluation of migratory bird use at the salt works and adjacent tidal habitats of South San Diego Bay. (Breeding bird activity at the salt works and waterbird use of the Bay's water areas were studied separately and are discussed in the sections that follow.) During the migratory bird use study, which included the period from February 1993 to February 1994, weekly counts were conducted of water-associated bird use within a 1,728-acre area (1,219 acres of salt ponds and 508 acres of adjacent tidal habitats). In that year, a total of 522,552 birds of 94 species were observed. As illustrated in Figure 3-10, shorebirds dominated both species diversity (27 species) and abundance (366,596 individuals or 70% of all birds observed). Species richness of the waterfowl and terns/gulls group followed with 22 and 18 species, respectively. The abundances of each of the other bird groups contributed much smaller portions of the total birds observed (gulls/terns 9.7%, waterfowl 8.3%, and grebes/loons 8.2%).

### Abundance Distribution of Migratory Birds in S. San Diego Bay 1993-1994



FWS weekly surveys Stadtlander & Konecny 1994

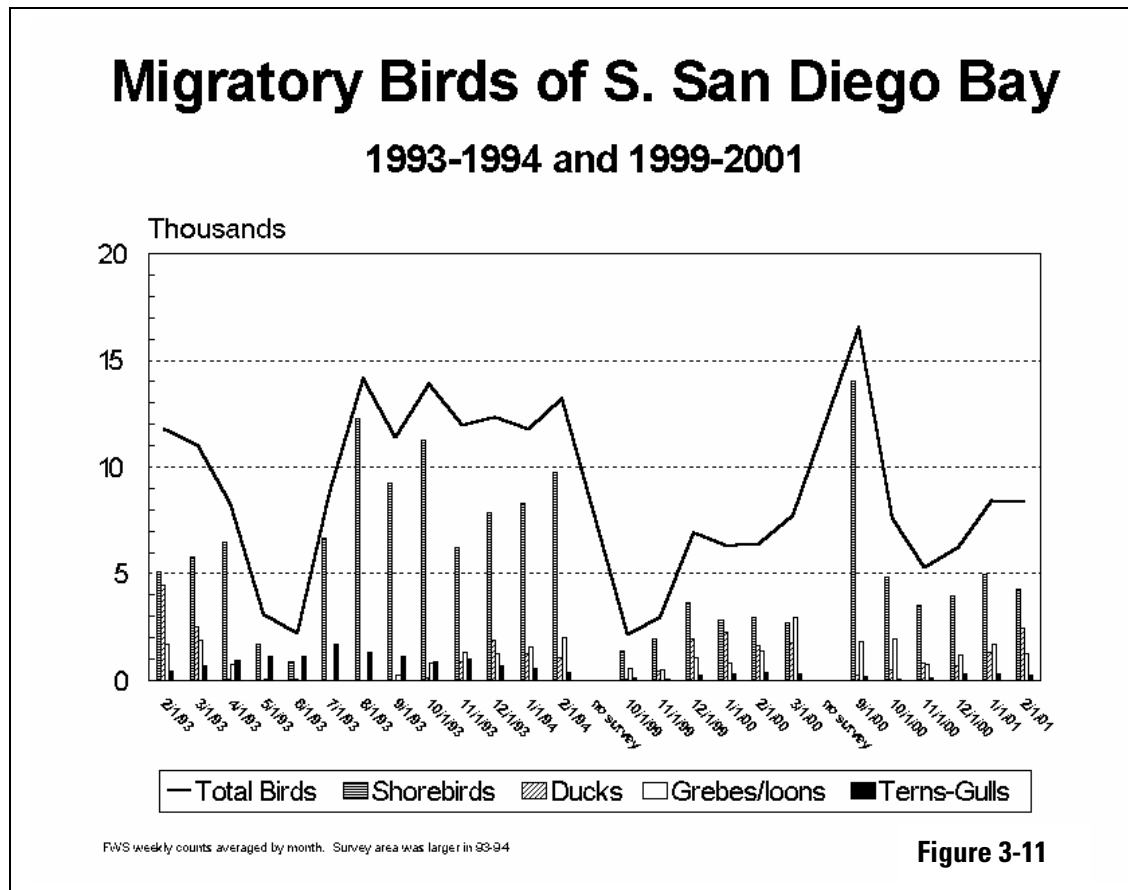
**Figure 3-10**

The migratory movements of birds in the Pacific Flyway follow a general trend of southerly movement away from breeding areas in the fall and northerly movement from overwintering areas back toward the breeding areas. Among individual species of birds there is great variation in distances traveled between breeding and overwintering areas, as well as the actual timing of their movements. For example, some western sandpipers or red-necked phalaropes breeding in northern Alaska typically pass through the San Diego Bay region in peak numbers in late summer, August and September. Most waterfowl numbers, such as black brant from Alaska or northern pintail from the Canadian plains, peak in November/December. Probably due to relatively mild winters, Southern California may be the overwintering destination for some birds, staying in the region until they begin their northward migration in February and March. Other species continue south into Central and South America. Some species, moving in large flocks (sandpipers and scaup, for example), may contribute to swings in bird abundance at one place as they move into and out of the survey area. Also, total bird abundance in the San Diego Bay region is typically at its lowest in May and June, when most shorebirds and waterfowl are to the north at their breeding locations. As discussed below, several species of terns and black skimmer arrive from the south to breed in the San Diego Bay region, with their numbers peaking in the summer, but declining during the winter.

This rise and fall in abundance of the different water associated bird groups at South San Diego Bay was evident during the year-long study (Stadtlander & Konecny 1994). On a monthly average, between 12,000 and 14,000 birds were present in the salt ponds and adjacent tidal habitats between August 1993 and February 1994, and between 2,000 and 3,000 birds in May and June 1993. From 1999 to 2001, the Service counted birds in portions of the salt ponds and adjacent mudflats during parts of the migratory season (M.

*Alfaro unpubl.*). When plotted together, as illustrated in Figure 3-11, these two discontinuous data sets confirm the pulse of bird migration, but are not completely comparable, due to somewhat different survey areas and duration. Shorebird peaks in August 1993 and September 2000 are due to the presence of many thousands of phalaropes in the salt ponds.

Within the shorebird group, western sandpipers (*Calidris mauri*) were most abundant. Due to the difficulty of separating other similar small shorebirds such as red knot, sanderling (*Calidris alba*), semipalmated plover, dunlin (*Calidris alpina*), least sandpiper



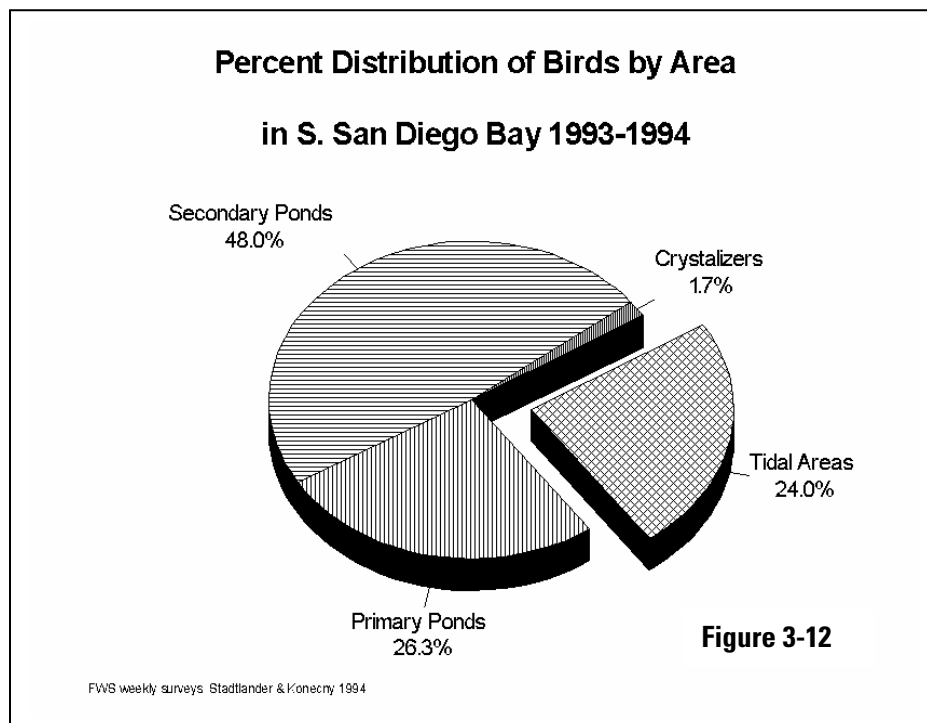
(*Calidris minutilla*), that rest and forage in large mixed flocks, these birds are sometimes considered in a group known as “peeps”. Peeps accounted for the largest shorebird presence in South San Diego Bay (49% of all shorebirds). Phalaropes, in very large numbers (7,000 –11,000) usually move into and out of the salt ponds between July and September, but are largely absent the rest of the year. Their northward migration pulse is much less or altogether absent, perhaps because the brine shrimp densities are reduced in late winter and early spring. Because of the large summer pulse, phalarope numbers constitute about 20% of all shorebird observations. Other shorebirds are present but in much less relative abundance, marbled godwit (9%), willet (8%), black-bellied plover (5%), and black-necked stilt (4%). Within the waterfowl group, lesser scaup (46% of all waterfowl) and bufflehead (19%) were most abundant, followed by surf scoter (8%), ruddy duck (*Oxyura jamaicensis*) (8%), American wigeon (*Anas americana*) (5%), and black

brant (5%). Eared grebes dominated the grebe/loon group while elegant terns dominated the tern/gull group, primarily due to their large summertime breeding population.

Of the 44 survey subareas, 70% of all birds used about 51% of the total study area. Total bird abundance per pond is presented in Table 3-10 and the percent distribution of birds per pond type is illustrated in Figure 3-12 (refer to Figure 2-6 for pond locations and type). Pond 23 had the highest total abundance, closely followed by Pond 22, due largely to two species, the red-necked phalarope and eared grebe. Pond 28, a pickling pond, was heavily used by shorebirds, probably roosting there when the tidal mudflats were inundated and unavailable for foraging. The tidal mudflats of the bay were used heavily by foraging shorebirds when exposed during low tides and by waterfowl (scaup, surf scoter, and brant) during high tides.

With respect to species diversity, the tidal areas to the north of the salt ponds had the highest number of species (67) observed. Pond 10, a primary pond where bay water is taken into the salt works system, has fluctuating water levels and slightly elevated salinities. The characteristics of this pond attract foraging shorebirds and fish eating birds, as well as roosting pelicans and gulls. Primary Ponds 14 and 15 attracted roosting gulls, terns, cormorants, bufflehead, wigeon, ruddy ducks, and especially foraging

<b>Pond #</b>	<b>Bird Abundance</b>	<b>Habitat Type</b>
23	48025	secondary
28	46093	pickling
22	44279	secondary
Bay 2	37780	tidal
Mudflat 1	33016	tidal
10	30999	primary
14	23452	primary
15	23073	primary
26	21416	secondary
20	20451	secondary
27	19249	secondary
Mudflat 2	18924	tidal



phalaropes. Secondary Ponds 26, 20, and 27 were used mostly by roosting shorebirds, gulls, terns, pelicans, cormorants, and when water levels were low, creating a thin layer of hypersaline water, by foraging shorebirds.

With the exception of pickling Pond 28, ponds with the least number of birds included all ten of the crystallizing ponds (about 127 acres). This is probably due to the extreme saline conditions, which eliminates any potential prey base for avian species, and high levels of disturbance related to salt harvesting activities.

Among the different bird groups that are present in South San Diego Bay at one time or another, each species makes its own use of the area to fulfill one or several essential life requirements (breeding, feeding, and/or resting). Several tern species use the salt pond levees for breeding and resting. However, as fish eaters, they must go outside the salt ponds to find food since the salt ponds support relatively little or no fish community. Conversely, phalaropes, which are only present during late summer while migrating, are probably storing energy for migration by consuming the densely abundant brine shrimp and brine flies present in some of the salt ponds.

Both red-necked phalaropes and Wilson's phalaropes are present on the salt ponds during migration. The red-necked phalarope has been observed during the months of July through October with the highest numbers occurring in August. On August 18, 1993, over 11,000 individuals were observed at the salt works (*Stadtlander and Konecny 1994*). During the 1993/1994 avian surveys, the ponds most frequented by this species were Ponds 14, 15, 21, and 22. In 1993, approximately 370 Wilson's phalaropes were observed at the salt works during the month of July (*Stadtlander and Konecny 1994*), while Jehl (1988) reported that in July 1986, a count of 5,000 to 10,000 individuals was made at the salt works, all of which were female.

Eared grebes are documented winter residents of the salt ponds and, with the exception of a few nonbreeders (less than 35 individuals in 1993), are virtually absent from the salt ponds during the summer months (*Stadtlander and Konecny 1994*). During the 1993/1994 avian surveys, eared grebes were observed within 33 of the 44 survey units and exceeded over a thousand birds for much of the fall and winter months (*Stadtlander and Konecny 1994*). The highest number of individuals observed in the ponds occurred on March 17, 1993 during migration, when approximately 2,360 eared grebes were counted. Of this total, approximately 1,080 individuals were observed in Ponds 22 and 23. Approximately 700 to 2,000 eared grebes were observed during the months of December 1993 and January 1994. The main wintering areas for this species are believed to be the Salton Sea, where approximately 1.5 million individuals occur in mid-winter, and the Gulf of California (*Jehl 1988*).

Observations made during the 1993/1994 survey indicated that many shorebird species rest in the safety of the salt pond complex while the nearby tidal mudflats that are their primary feeding area are inundated by the high tide. Other shorebirds, such as American avocet and black-necked stilts, forage both in and out of the ponds and nest within the secondary pond system. Ponds 10 and 10A are probably exceptions to these generalities since they are subject to the lowest salinities of all the salt ponds. This combines with the irregularly fluctuating water level within these ponds and creates shallow water depths similar to those occurring in adjacent tidal areas, thus providing foraging areas for shorebirds.

The importance of the wetlands in South San Diego Bay to shorebirds is also evident from the data provided by the Pacific Flyway Project, the first ever attempt to establish baseline data on the abundance and distribution of shorebirds in wetland habitats along the Pacific Flyway from Alaska to Baja California. The shorebird migration/wintering data for the South San Diego Bay that is provided in Table 3-11 was gathered during surveys conducted between April 1988 and August 1995.

Table 3-11 Shorebird Migration/Wintering Data for South San Diego Bay			
Species Observed	Number of Individuals Observed During Various Seasons		
	Spring	Fall	Winter
Black-bellied Plover <sup>1</sup>	200	600	600
Black-necked Stilt	200	300	200
Willet	300	900	700
Long-billed Curlew <sup>2</sup>	<50	100	<50
Marbled Godwit <sup>1,2</sup>	700	1,400	1,600
Black Turnstone <sup>2</sup>	100	<50	<50
Red Knot <sup>1</sup>	600	600	500
Sanderling <sup>2</sup>	500	300	300
Western Sandpiper <sup>1,2</sup>	6,600	5,500	3,500
Dunlin <sup>1,2</sup>	200	0	300
Dowitcher spp. <sup>1,2</sup>	1,900	1,100	1,100
Red-necked Phalarope <sup>2</sup>	0	7,400	0

<sup>1</sup> Species that uses the mudflats extensively on migration and during the winter

<sup>2</sup> Species that is either a Bird of Conservation Concern or Highly Imperiled or of High Concern in the U.S. Shorebird Conservation Plan

Some waterfowl (such as scaup) rest in floating groups (rafts) either inside the salt ponds or on calm, undisturbed water areas of the bay. The salt ponds offer relatively little food for most waterfowl, therefore, species such as black brant, greater scaup, redhead, ring-necked duck, and common merganser were observed most often outside the confines of the salt works in the bay. American widgeon, gadwall, mallard, northern pintail, cinnamon teal, northern shoveler, bufflehead, ruddy duck, red-breasted merganser, and American coot were recorded both within the bay and within the salt pond complex. Lesser scaup and surf scoter, although observed both within and outside the salt ponds, were found in the highest concentrations outside the salt pond system and within the lowest salinity ponds (Ponds 10 and 11).

#### **Migratory Bird Use of the Water Areas of South San Diego Bay**

San Diego Bay contributes more protected, shallow, bay habitats to the Pacific Flyway waterbird populations than any other bay or estuary situated along the 180-mile coastal region of southern California. The Central and South Bays make up approximately 65% (7,130 acres) of the entire open water habitat of the bay. The water areas of South San Diego Bay (from approximately the Sweetwater River mouth south to the outer levees of the salt ponds) are less dredged and relatively less industrialized than the Central and North Bay regions where Navy and port wharves and small boat marinas abound. Most of the South Bay water area is less than 10 feet deep (MLLW) and supports extensive



eelgrass beds and intertidal mudflats. A wide variety of waterbirds have previously been documented using the bay's habitats (*MacDonald et al. 1990*).

A second study conducted by the Service in 1993 and 1994 focused on avian use of the water areas in the Central and South bay. The Service's Coastal Program conducted weekly waterborne surveys (*Manning 1995*) between April 15, 1993 and April 14, 1994 to characterize species richness, relative abundance, and spatial distribution of the waterbird community in the Central and South San Diego Bay. A cumulative total of 149,553 individual birds of 52 species were observed in during these surveys. Species richness peaked during the winter at 35 species and was lowest during the summer at about 15 species. Abundance follows the same pattern of higher abundances during migration (November to March) with a peak single day count of 12,006 birds in December 1993. April to September waterbird abundance in the Central and South Bay was typically fewer than 1,000 birds. Of the cumulative total number of birds observed, 66% were seen in the South Bay and 34% in the Central Bay.

Surf scoters composed the largest proportion (64%) of all birds observed, followed by scaup (11%), bufflehead (6%), and brant (5%). Together, brown pelicans, grebes, and cormorants represented about 8% of the total, while all other species were about 6% of the total. The highest single day total of surf scoters was 7,458 in December 1993 in Central and South San Diego Bay. The highest single day total for scaup was 1,937 in December 1993, bufflehead numbered 715 in December 1993 and brant numbered 714 birds in March 1994. About 61% of all surf scoters and virtually all brant observed during the surveys occurred within the South Bay. While scoter, scaup, and brant populations using San Diego Bay may have declined since the 1970s, about 40% of all California surf scoters and 30% of all brant using California's waters can be found in San Diego Bay during winter (*Bartonek 1994, USFWS 1995, and U.S. Navy 2000*). The results of the surveys also showed that the greatest abundance of waterbirds within the Central and South San Diego Bay occurred in "areas with relatively low water recreational intensity" (*Manning 1995*).

### **Breeding Birds**

#### **Nesting Seabirds**

The natural breeding habitats for the ground nesting seabirds that nest within the San Diego Bay NWR include salt marshes, sandy beaches, and barrier islands. Although these habitats were plentiful in coastal San Diego County in the past, the vast majority of these areas have either been lost to urban and recreational development or now experience significant levels of disturbance. There are a few natural nesting areas remaining along the southern coast of San Diego County, however, even these areas are actively managed to control disturbance and predation.

With the loss of historic breeding grounds, many seabirds are now nesting on manmade landforms that resemble in some way their preferred native habitats. These landforms include nonvegetated or lightly vegetated flat, open ground; manmade sand islands; levees; and berms. Two important seabird nesting areas within San Diego Bay are located within the San Diego Bay NWR: the D Street Fill and the levees around the salt ponds.

D Street Fill. Within the Sweetwater Marsh Unit, the D Street Fill provides nesting habitat for the federally listed endangered California least tern. This area is currently managed to provide about 35 to 40 acres of unvegetated, sandy substrate on both Refuge and Port lands to support least tern nesting. Least terns were first discovered nesting at

this location in 1973 (*USFWS 2000a*). Although some 20 to 25 pairs nested here in 1973, fledging success was poor due to unregulated human disturbance. Similar conditions occurred until 1978, when 47 breeding pairs produced 15 fledglings. Initial nesting attempts in 1980 were disrupted by off-road vehicles. In 1988, the Biological Opinion for the Combined Sweetwater River Flood Control and Highway Project defined the historic nest site acreage on the D Street Fill as 44 acres (*USFWS 1988b*), which included 12 acres on the western end of the fill that is owned by the Port.

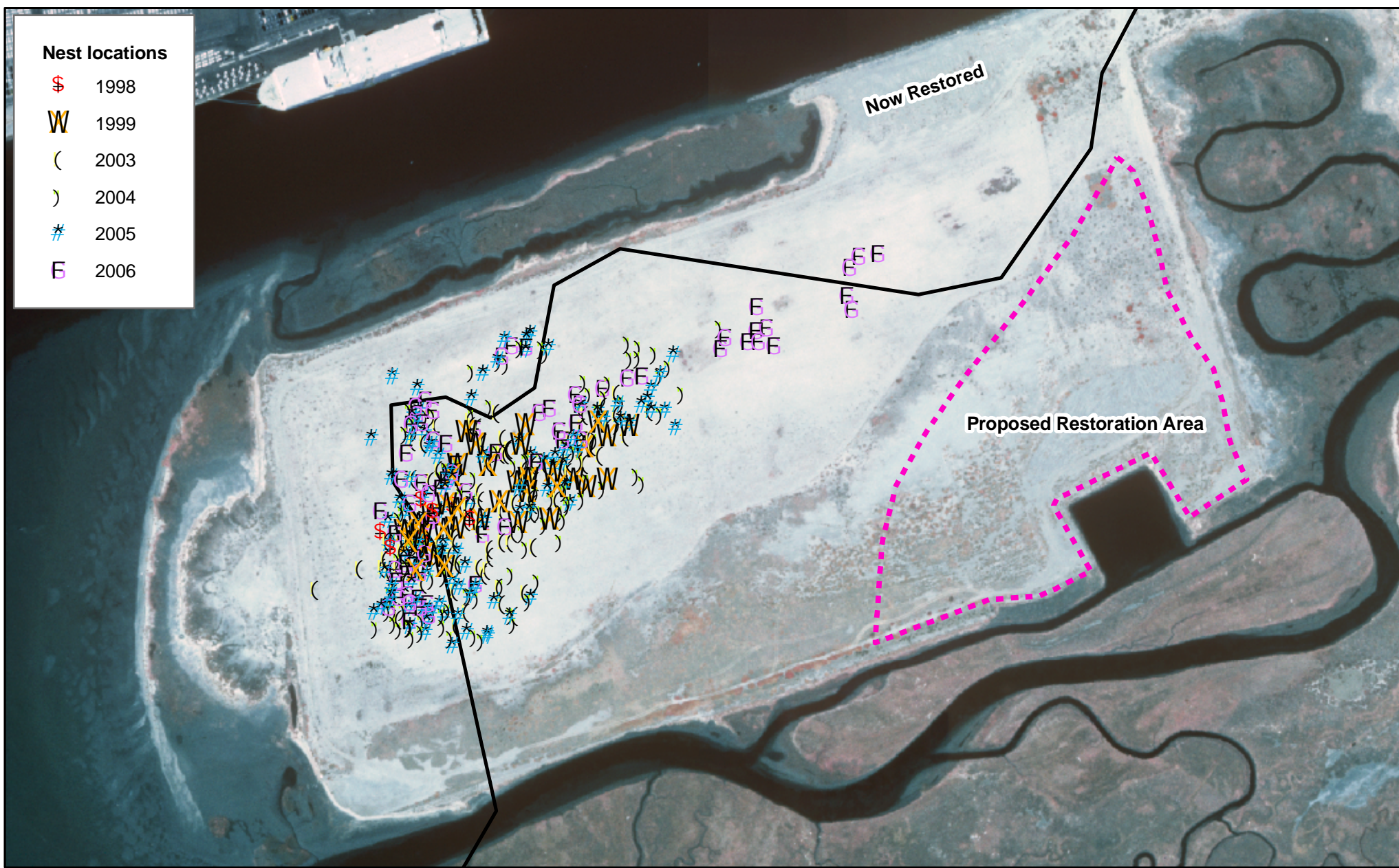
The colony abandoned the area in the mid-1980s and did not return in substantial numbers until 1992, when 135 nesting pairs were observed. Unfortunately, fledging success during 1992 was limited due to severe weather associated with an El Niño event, as well as harassment by avian predators. Since 1994, least terns have regularly nested here, with nesting pair numbers fluctuating between six and 38 pairs. In 2001, the site supported 3.6 percent of the least tern breeding pairs around San Diego Bay, with fair reproductive success (*USFWS 2001*). Data from 1998, 1999, and 2003 through 2005 indicates that least tern nesting activity is generally confined to a ten-acre area near the western end of the fill (Figure 3-13). The number of least tern nests at the D Street Fill between 1999 and 2005 is provided in Table 3-12 and additional discussion is included in Section 3.4.6.1.

<b>Table 3-12</b> <b><u>Numbers of California Least Tern and Snowy Plover Nests at the D Street Fill</u></b> <b><u>(1999 – 2005)</u></b>							
	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>
<u>California Least Tern</u>	<u>36</u>	<u>34</u>	<u>32</u>	<u>24</u>	<u>91</u>	<u>111</u>	<u>101</u>
<u>Western Snowy Plover</u>	<u>2</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>

Salt Pond Levees. Various levees within the salt works provide nesting habitat for a diverse and abundant array of colonial nesting seabirds, including the federally endangered California least tern, Caspian tern, elegant tern, royal tern (*Thalasseus maximus*), gull-billed tern, Forster's tern (*Sterna forsteri*), and black skimmer. Of these species, the gull-billed tern, elegant tern, and black skimmer are listed by the Service as Birds of Conservation Concern. Based on observations of these nesting colonies and the nesting colonies of these species elsewhere, it appears that the qualities that attract ground nesting seabirds to the salt pond levees include limited human disturbance, the isolated nature of the area, the availability of exposed or lightly vegetated open ground, and unrestricted visual access from the levees into the surrounding area.

The pond levees, which cover about 100 acres, vary in width from 2 to 10 meters and range about 1 to 2.5 meters in height above the water level. Depending on the amount of erosion, the levee banks may be vertical or gently sloping. The substrate of the perimeter road is gravel over compacted soil, while the inner levees are composed of soft powdery silt. The substrate on some levees has recently been enhanced to improve nesting conditions by topping the levees with several inches of clean, light sand. Salt crystals can also be found along the tops of some levees, particularly within the secondary and pickling ponds.

Little data is available on the early (1900 through 1970) use of the salt works by nesting seabirds. A statewide survey of California least tern nesting areas documented the presence of least tern nests at the salt works between 1968 and 1970 (*Craig 1971*).



**Figure 3-13**  
**Least Tern Nesting on the D Street Fill**

Sources: 1998-2005 - Unified Port of San Diego, 2006 - R. Patton pers. comm., USFWS, Local Agency Partnership 2000

Monitoring of avian populations at the salt works was also conducted by Elizabeth Copper in the late 1970s and early 1980s. In 1987, Pacific Southwest Biological Services, Inc. conducted a survey of the birds occurring on portions of the salt works in order to understand the potential effects of proposed alterations to the existing levees. It was not until 1993 that a comprehensive investigation of the avian species in the South Bay was undertaken by the Service (*Manning 1993, Stadtlander 1994, Konecny 1995*). The Service's Coastal Program initiated these studies to obtain information regarding species diversity, abundance, and habitat use at the salt works. Yearly monitoring of the nesting activities on the salt works has followed this initial effort.

During the 1998 nesting season, the Service monitored nesting activity at the salt works every three to four days from April 3 to September 11, for a total of 44 visits (*Terp and Pavelka 1999*). Monitoring results showed that seabird nesting generally occurred on the levees of the primary ponds located to the east of the Otay River, as well as on the levees in and around Ponds 23, 24, 25, and 27, and between Ponds 25 and 30 and 27 and 41.

Since 1999, the levees have been routinely monitored during the nesting season. The numbers and locations of nests per species that have been documented as a result of this monitoring are provided in Tables 3-13 and 3-14. This data illustrates the variation in numbers and locations of nests within the salt works from year to year. These variations could be affected by conditions within the site, but are more likely the result of changing conditions in adjacent areas, particularly the ocean, that cannot be controlled by management actions on the Refuge. A brief description of nesting activity within the South San Diego Bay Unit per species is provided in the following paragraphs.

<b>Table 3-13</b> <b>Number of Waterbird Nests at the South San Diego Bay Unit</b> <b>(1999 – 2005)</b>							
	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>
<b><u>Seabird Nesting</u></b>							
California least tern	<u>25</u>	<u>44</u>	<u>45</u>	<u>39</u>	<u>62</u>	<u>49</u>	<u>34</u>
Gull-billed tern	<u>29</u>	<u>27</u>	<u>47</u>	<u>39</u>	<u>59</u>	<u>49</u>	<u>73</u>
Caspian tern	<u>280-370</u>	<u>500-575</u>	<u>365-450</u>	<u>379</u>	<u>332</u>	<u>313</u>	<u>357</u>
Royal tern	<u>36</u>	<u>1-2</u>	<u>3</u>	<u>1-3</u>	<u>28-31</u>	<u>38</u>	<u>52</u>
Elegant tern	<u>3,100</u>	<u>86</u>	<u>107-110</u>	<u>37-100</u>	<u>10,300-10,500</u>	<u>1,020</u>	<u>3,050-3,200</u>
Forster's tern	<u>174-188</u>	<u>325-327</u>	<u>419-438</u>	<u>390+</u>	<u>266</u>	<u>275</u>	<u>415</u>
Black skimmer	<u>395-410</u>	<u>224-231</u>	<u>419-430</u>	<u>443+</u>	<u>541</u>	<u>496</u>	<u>752</u>
<b><u>Other Nesting Waterbirds</u></b>							
Western Snowy Plover	<u>0</u>	<u>1</u>	<u>3</u>	<u>3</u>	<u>0</u>	<u>2</u>	<u>4</u>
Double-Crested Cormorants	<u>80-84</u>	<u>41</u>	<u>39-53</u>	<u>49+</u>	<u>74-77</u>	<u>49</u>	<u>77</u>

Source: (Patton 2006b)

California Least Tern. The California least tern, which is discussed in greater detail in Section 3.4.6.1, is present in South San Diego Bay only during the breeding season. In



**Table 3-14**  
**Locations<sup>1</sup> of Waterbird Nest Sites at the Salt Works Between 1999 – 2005**

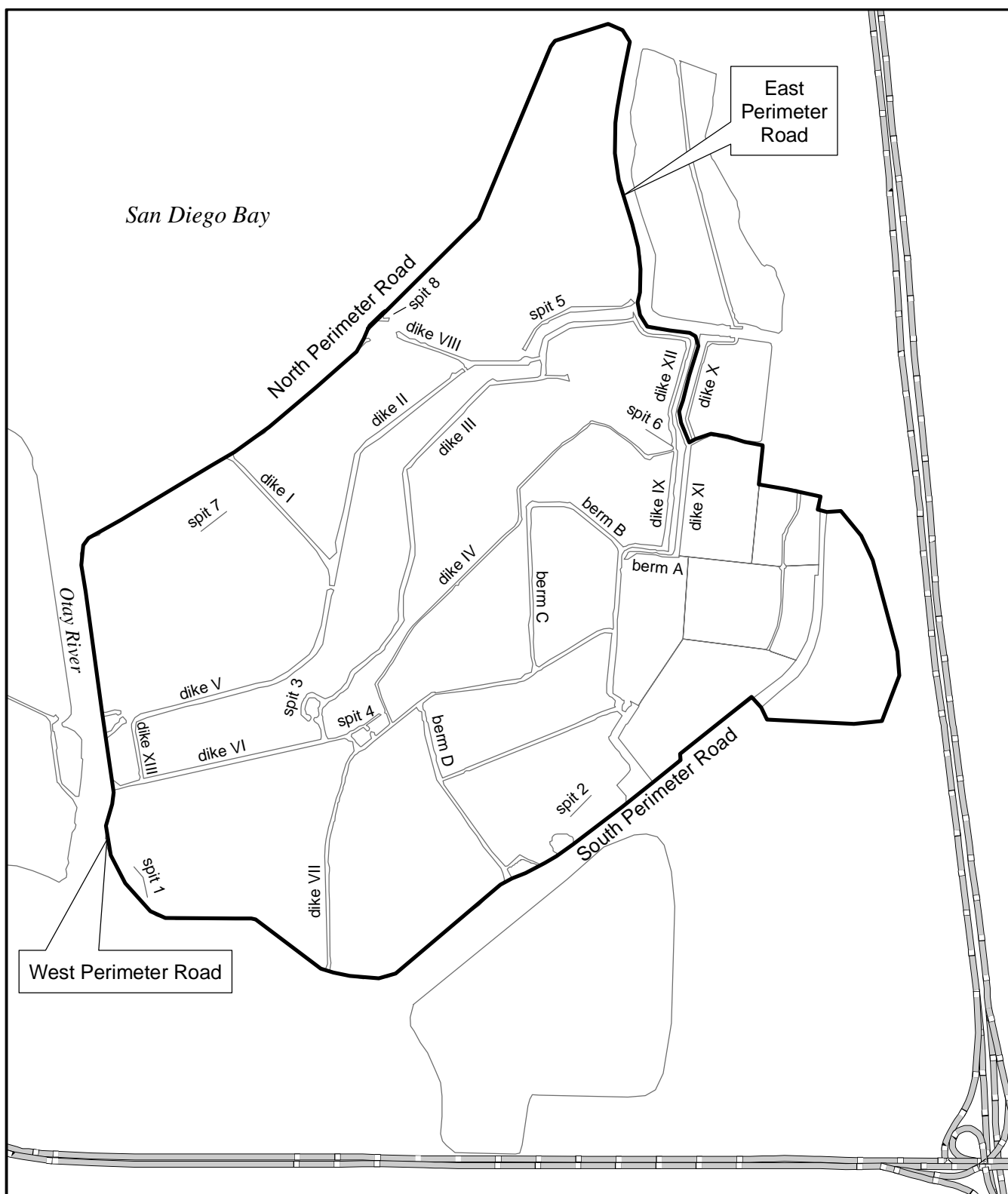
	<u>1999</u>	<u>2001<sup>2</sup></u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>
<b><u>Nesting Seabirds</u></b>						
<u>California least tern</u>	<u>dike IX, X, XII</u>	<u>dike IV, IX, X</u>	<u>dike IV, IX, spit 6, berm A</u>	<u>dike IV, VII, IX, X, XII, spit 4, 6</u>	<u>dike IV, VII, spit 4, berm b</u>	<u>dike IV, VI, VII, IX, X, XII</u>
<u>Gull-billed tern</u>	<u>dike I, II, III, IV, V</u>	<u>dike II, III, IV, V</u>	<u>spit 5, dike III, VIII</u>	<u>dike II, III, IV, V</u>	<u>dike II, III, IV, V, VIII, berm C</u>	<u>perimeter road (w), dike II, III, VI, VII, XIII</u>
<u>Caspian tern</u>	<u>dike II, III, VIII</u>	<u>dike V, spit 3</u>	<u>dike II, V</u>	<u>dike II, V, spit 3</u>	<u>dike II, V, VIII</u>	<u>dike II, V, VIII</u>
<u>Royal tern</u>	<u>dike III</u>	<u>dike V</u>	<u>dike V</u>	<u>dike II, III, V</u>	<u>dike II, IV</u>	<u>dike II, V</u>
<u>Elegant tern</u>	<u>dike III</u>	<u>dike II, V, spit 1</u>	<u>dike V, spit 1</u>	<u>dike I, II, III, IV, V</u>	<u>dike II, III, IV</u>	<u>dike II, V</u>
<u>Forster's tern</u>	<u>perimeter roads (n, w), dike I, III, IV, V, spit 1</u>	<u>perimeter roads (n, w), spit 1, dike I-VI, XIII</u>	<u>perimeter roads (n, w), dike I, II, III, V, VII, spit 1</u>	<u>perimeter roads (n, w), dike I, II, III, V, VI, VII, spit 1</u>	<u>perimeter roads (n, w), dike I, II, III, V, VI, VII</u>	<u>perimeter roads (n, w), dike II, III, V, VI, spit 1</u>
<u>Black skimmer</u>	<u>dike II, III, IV, V, VI, VII, spit 1</u>	<u>perimeter road (n), dike II, III, IV, V, XIII, spit 1, 7</u>	<u>perimeter road (n, w), dike I, II, III, IV, V, XIII</u>	<u>perimeter roads (n, w), dike III, IV, VI, VII, XIII, spit 4</u>	<u>perimeter roads (n, w), dike II, III, IV, V, VI, VII, XIII</u>	<u>perimeter roads (n, w), dike II, III, VI, VII, XIII</u>
<b><u>Other Nesting Waterbirds</u></b>						
<u>Western Snowy Plover</u>	<u>none observed</u>	<u>dike XII</u>	<u>dike IV, spit 6</u>	<u>none observed</u>	<u>dike VIII, berm D</u>	<u>dike IV</u>
<u>Double-crested cormorant</u>	<u>dike II, III, barge</u>	<u>dike III, VIII, barge</u>	<u>barge</u>	<u>dike I, II, V, barge</u>	<u>dike II, barge</u>	<u>dike I, V, barge</u>
<u>American avocet</u>	<u>dike I, III, IV, V</u>	<u>all major dikes</u>	<u>all major dikes</u>	<u>all major dikes</u>	<u>all major dikes</u>	<u>all major dikes</u>
<u>Black-necked stilt</u>	<u>perimeter road (w), dike I, III, IV, V, VIII</u>	<u>all major dikes</u>	<u>all major dikes</u>	<u>all major dikes</u>	<u>all major dikes</u>	<u>all major dikes</u>
<b><u>Other Nesting Birds<sup>3</sup></u></b>						
<u>Mallard</u>	<u>dike II</u>	<u>dike I, II</u>	<u>perimeter road, dike II</u>	<u>dike I, II, III, V</u>	<u>perimeter road, dike III</u>	<u>Locations not noted</u>
<u>Gadwall</u>	<u>dike I, V</u>	<u>dike I, II, III, V</u>	<u>dike II, V</u>	<u>dike III</u>	<u>perimeter road (n)</u>	<u>Locations not noted</u>
<u>Killdeer</u>	<u>none observed</u>	<u>perimeter road</u>	<u>perimeter road (w)</u>	<u>perimeter road (w)</u>	<u>perimeter road (w)</u>	<u>Locations not noted</u>
<u>Horned Lark</u>	<u>dike III</u>	<u>dike XII</u>	<u>not observed</u>	<u>dike III</u>	<u>dike VII</u>	<u>Locations not noted</u>
<u>Belding's savannah sparrow</u>	<u>dike I, II</u>	<u>dike III, V</u>	<u>dike I, III</u>	<u>dike I, III</u>	<u>Dike III, VI</u>	<u>Locations not noted</u>

<sup>1</sup>These locations are illustrated in Figure 3-14.

<sup>2</sup>No data is available for 2000.

<sup>3</sup>One to a few nest observations; not specifically searched for, but encountered during monitoring for other species.

Source: (Patton 1999, 2004a, 2004b, 2004c, 2006a, 2006b)



**Figure 3-14**  
**Nesting Locations as Described in Table 3-14**

Source: USFWS

0 500 1,000  
 Feet

Carlsbad Field Office - 2003  
 /stacey/fig\_4-03/fig3-14.mxd

1970 limited surveys were initiated in the San Diego to document nesting locations and population status for this species. At that time the salt works was identified as one of two nesting sites within San Diego Bay. California least tern breeding populations at the salt works have ranged from a high of 62 pairs in 1993 to two pairs in 1970, with no known nesting during 1982 and 1983. Between the 1978 and 2001 nesting season, least tern nesting use at this site has been confirmed for 22 out of the 24 years. In 2002, 39 nests were observed, of which only two were estimated to have fledged from the site (*Patton 2004a*) and in 2005, 34 nests were observed with two to three assumed to have fledged from the site (*Patton 2006b*). Poor least tern reproductive success at the salt works is partially attributed to high levels of predation of chicks and eggs.

Since 1999, least terns have nested in several locations within the salt works. Until 2003, the terns tended to nest on the eastern levees of Ponds 25 and 27 and the western levee of Pond 30. In 2003, use of the eastern levees of Ponds 25 and 27 decreased, but new nesting areas on dikes IV and VII were established. In 2004, nesting was almost exclusively limited to dikes IV and VII and spit 4 (refer to Figure 3-14). A similar nesting distribution occurred in 2005, although limited nesting was once again observed in the vicinity of Ponds 25, 27, and 30.

Gull-billed Tern. The western subspecies of the gull-billed tern, which is discussed in greater detail in Section 3.4.7.1, was recorded in South San Diego Bay in 1985. The first western gull-billed tern nest was observed at the salt works in 1987 (*Terp and Pavelka 1999*). Approximately eight to 10 nesting pairs were observed at the salt works between 1993 and 1998. In 2003, at least 59 nests were established by 32 to 37 pairs (*Patton 2004b*) and in 2005, 73 nests were observed (*Patton 2006b*). This tern is only present during the breeding season (March through July) and the salt works is one of only two locations in the western U.S. where this tern breeds. The other location is the Salton Sea, California.

The location of gull-billed tern nests within the salt works has been documented since 1999. In 1999, these terns nested in various locations within the center of the salt works, primarily the south end of dike I, the northeast end of dike V, the center portion of dike IV and an adjacent portion of dike III. In 2002, the nests were concentrated primarily around the eastern end of Pond 13. In 2005, nests were observed along a significant portion of dike III, as well as in smaller patches along dikes II, VI, VII, and XIII, and two small spits located immediately to the east of the western perimeter road.

Caspian Tern. Based on the high abundance of Caspian terns during the nesting season and few observations from November through February, Caspian terns are believed to use the salt works primarily as a breeding site. Nesting Caspian terns were first recorded at the salt works in 1941. Based on observations in 1993, 1994, 1997, and 1998, the breeding colony of Caspian terns at the salt works ranges from 200 to 300 breeding pairs per year (*Terp and Pavelka 1999*). In 2005, approximately 350 Caspian tern nests were observed at the salt works (*Patton 2006b*). Although the specific location of Caspian tern nests vary from year to year, in general, the nests tend to be located along the interior levees of the eastern primary ponds.

Royal Tern. At one time the royal tern was considered the most abundant large tern in California; however, during the 1900s their numbers declined throughout the state (*Unitt 1984*). This tern, which was first discovered nesting at the salt works in 1959, is present in the South Bay in small numbers throughout the year. Since 1959, one or two pairs have occasionally nested in South San Diego Bay. In 2002, two single egg nests were observed



(Patton 2004a), while 52 nests were observed in 2005 (Patton 2006b). In 1999, royal tern nests were observed at the northeastern end of dike III, however, in subsequent years, royal tern nests generally have been located among active elegant tern nests. The exception was in 2002, when the two to three nests observed at the site were located among Caspian tern nests.

Elegant Tern. The elegant tern can be observed in the South Bay between March and October. Over the years, surveys have documented the presence of more non-breeding migratory elegant terns than breeding pairs. In 1998, approximately 100 breeding pairs of elegant terns were documented, while about 1,000 non-breeding birds were observed in June, over 3,000 in late July, and 500 by late August. The first documented nesting of this species at the salt works occurred in 1959. The salt works is one of only a few nesting locations for elegant terns in the United States. The number of breeding pairs at the salt works has fluctuated significantly over the years, with over 800 pair observed in 1981 (Unitt 1984), none in 1990 (Terp and Pavelka 1999), 511 nests in 1993, and 3,100 nests in 1999 (Patton 1999). Only two nesting pairs were observed in 1997 (Horn and Dahdul 1998), 37 to 100 in 2002, and as many as 10,500 nests in 2003 (Patton 2004a). In 2005, it was estimated that 3,050 to 3,200 nests were established (Patton 2006b).

The nest locations within the salt works for elegant terns have varied from year to year, just as the number of nests has varied. In 1999, elegant terns nested exclusively on dike III. However, in 2001 and 2002, these terns were observed nesting slightly to the west on dike II (2001 only), V, and spit 1. In 2003, when the number of nests at the salt works was significantly higher than in previous years, these terns nested along dike II, including the intersection of dike I and II, dike III and V, and small portion of dike IV. In 2004, nesting was more centralized, occurring on dike II, III, and IV. In 2005, nests were limited to dike II and V.

Forster's Tern. Forster's terns are present in the South Bay throughout the year, but their numbers peak in May and November. This species primarily breeds in the interior of North America with a few colonies located on the Pacific, Atlantic, and Gulf coasts. The first reported nesting at the salt works occurred in 1962 and the colony size has increased substantially since that time. Stadtlander (1993) reported 510 Forster's tern nests in 1993, 345 nests were observed in 1994 (Konecny 1995), 225 nests were counted in the 1998 surveys (Terp and Pavelka 1999), and during the 2005 breeding season, at least 415 nests were observed (Patton 2006b). The location of Forster's tern nests vary from year to year, however, nests are routinely observed along the north and west perimeter road and dike II and III. Various other dikes and small spits may also be used for nesting in a given year.

Black Skimmer. Approximately 280 pairs of black skimmers were observed nesting at the salt works during the 1998 investigations. This species is generally present in the South Bay between April and September and in recent years has most often nested on the spit within Pond 23. The first reported nesting of black skimmers at the salt works was a single breeding pair in 1976 (Stadtlander 1994). The number of breeding pairs has increased significantly since that time. During the 2005 nesting season, approximately 752 black skimmer nests were observed at the salt works (Patton 2006b). The distribution of black skimmer nests within the salt works is similar to that of the Forster's tern, with nesting occurring on the north and west perimeter roads in 2001, 2003, 2004, and 2005.

### Other Nesting Birds

Sweetwater Marsh Unit. The federally listed threatened western snowy plover is another ground nesting species that has historically nested on the D Street Fill. Although snowy plovers have nested here in the past, nesting attempts have been limited and sporadic (refer to Table 3-12). Two nests were identified in 1999 and one in 2000. No nests have been observed here since 2000 (Patton 2006b). The reason for plover abandonment of this site may be due in part to inadequate chick and adult access to adjacent foraging areas (Patton pers. comm.). Plover nests observed on the D Street Fill in 1998 and 1999 were located in the same general area as the tern nest sites depicted in Figure 3-12.

The federally listed endangered light-footed clapper and State listed endangered Belding's savannah sparrow both nest within the salt marsh habitat of the Sweetwater Marsh Unit. Additional information regarding these species is provided in Sections 3.4.6.1 and 3.4.6.2 respectively.

The upland areas on the Sweetwater Marsh Unit also provide nesting habitat for various hummingbird species, as well as horned larks (*Eremophila alpestris*), loggerhead shrikes (*Lanius ludovicianus*), and various other passerine species. Both horned larks and killdeer have been observed nesting on the D Street Fill.

Salt Pond Levees. In addition to providing habitat for nesting seabirds, as described above, the South San Diego Bay Unit also provides suitable nesting habitat for a variety of other avian species. Western snowy plovers were first documented nesting on the levees of the salt ponds in 1978, when 16 pairs nest were observed. The population of snowy plovers in South San Diego Bay has declined substantially since then. In 1993, an estimated seven breeding pairs were present at the salt works. Only one nest was located in 1994, five in 1997, and three in 1998 (Terp and Pavelka 1999). In 2005, four nests were identified at the salt works and it was estimated that three fledglings were produced (Patton 2006b).

American avocets and blacked-necked stilts also nest on the salt pond levees. In fact, the only recent nesting of these two species in San Diego Bay has been within the salt works (Patton 2004a). Nests tend to be abundant and distributed throughout the salt pond levees. In May 2002, at least 30 avocet nests and 24 stilt nests were recorded. Some of the other species observed nesting within the salt works in 2004 were killdeer (*Charadrius vociferous vociferous*), horned lark, gadwall, and mallard (*Anas platyrhynchos*).

Belding's savannah sparrows nest in the pickleweed salt marsh vegetation that occurs along the outer levees of the salt ponds, within the lower reach of the Otay River, and along the edges of the South Bay in remnant patches of salt marsh vegetation. The light-footed clapper rail has also been detected nesting within the Otay River channel, upstream of the salt works.

Double-crested cormorants (*Phalacrocorax auritus*) annually nest within the salt works on a dredging barge anchored in the salt ponds and in a few locations along the salt pond levees. This nesting activity has been noted since the late 1980s. Nesting begins in April and continues through late July. During the 1998 colonial seabird nesting study, 34 cormorant nests were observed on the barge, with over 70 adults and about 42 young were present at the time of observation (Terp and Pavelka 1999). A total of 77 cormorant nests were observed at the salt works during the 2005 nesting season (Patton 2006b).

### **Birds of Prey**

The northern harrier is the most common bird of prey observed on the Sweetwater Marsh Unit where it occurs year round, hunting over salt marsh and upland areas within the Refuge. Other birds of prey frequently observed include the Cooper's hawk (*Accipiter cooperii*), red-tailed hawk, American kestrel, and osprey (*Pandion haliaetus*). Less common, but predictable visitors to the Refuge include the American peregrine falcon, sharp-shinned hawk (*Accipiter striatus*), red-shouldered hawk (*Buteo lineatus*), white-tailed kite (*Elanus leucurus*), and prairie falcon (*Falco mexicanus*). Occasional visitors include the Swainson's hawk (*Buteo swainsoni*) and merlin (*Falco columbarius*). The short-eared owl is a rare winter visitor to salt marsh habitat (Unitt 1984) and is occasionally sighted at Sweetwater Marsh. Although rare, there are also documented sightings of ferruginous hawk (*Buteo regalis*), long-eared owl (*Asio otus*) and golden eagle (*Aquila chrysaetos*).

During the 1993-1994 avifauna surveys, as well as during subsequent monitoring by Service staff, kestrels, ospreys, red-tailed hawks, and northern harriers were frequently observed in the area. Other common species observed within the South San Diego Bay Unit include the short-eared owl, Cooper's hawk, merlin, and sharp-shinned hawk. White-tailed kites, red-tailed hawks, and Cooper's hawks are also frequently sighted within the Otay River floodplain. During a survey of the railroad right-of-way in 2000, a golden eagle was sighted in the vicinity of the Otay River (*Tierra Environmental Services 2000*). Peregrine falcons are occasionally observed in the vicinity of the salt works. Burrowing owls have been recorded in this area in the past, but were absent from the area for several years. Recent observations by Refuge staff indicate that two pairs have reestablished a presence on the Sweetwater Marsh Unit.

### **Passerines and Other Birds**

Some of the passerines commonly observed on both the Sweetwater Marsh and South San Diego Bay Units include the Belding's savannah sparrow, western kingbird (*Tyrannus verticalis*), northern mockingbird (*Mimus polyglottos*), western meadowlark (*Sturnella neglecta*), and California towhee (*Pipilo crissalis*). In addition, a number of nonpasserines, including mourning doves (*Zenaida macroura*) and a variety of hummingbirds, are commonly observed on these Refuges. At the Sweetwater Marsh Unit, it is not uncommon to observe a belted kingfisher (*Ceryle alcyon*) in the marsh to the southwest of the Nature Center. Tree swallows (*Tachycineta bicolor*), cliff swallows (*Petrochelidon pyrrhonota*), barn swallows (*Hirundo rustica*), and rough-winged swallows (*Stelgidopteryx serripennis*) have also been observed feasting on the swarms of brine flies that occasionally occur along the tidal channel between Ponds 15 and 28 in the South Bay.

Although several surveys have been conducted at the salt works and within the open waters of the bay to document waterbird and shorebird use in these areas, a comprehensive survey has not been completed of all of the birds supported by the habitats of the Sweetwater Marsh and South San Diego Bay Units. Appendix C includes lists of those birds that have been observed in and around the Sweetwater Marsh and South San Diego Bay Units. Note that these lists are not intended to represent a complete listing of the species supported on the Refuge.

#### **3.4.4.2 Mammals**

A comprehensive survey of the various mammals occurring on the Refuge has not been completed to date; however, private consultants have previously conducted limited studies (*Jones & Stokes*

Associates, Inc. 1983, Butler/Roach Group, Inc. 1987, Pacific Southwest Biological Service, Inc. 1990, and Tierra Environmental Services 2001) for portions of the Refuge for reason unrelated to Refuge activities. A list of the mammal previous observed on the Refuge is provided in Table 3-15. It is likely that all of these species, as well as several others, occur on both Refuge Units, but have not yet been officially recorded.

Table 3-15 Mammals Observed on the San Diego Bay NWR		
Common Name	Scientific Name	Where Observed
Virginia opossum	<i>Didelphis virginiana</i>	Sweetwater Marsh Unit
Brush rabbit	<i>Sylvilagus bachmani</i>	Sweetwater Marsh Unit
Desert cottontail	<i>Sylvilagus audubonii</i>	Both Refuge Units
San Diego Black-tailed Jackrabbit	<i>Lepus californicus bennettii</i>	Sweetwater Marsh Unit
California ground squirrel	<i>Spermophilus beecheyi</i>	Both Refuge Units
Botta's pocket gopher	<i>Thomomys bottae</i>	Sweetwater Marsh Unit
San Diego pocket mouse	<i>Perognathus fallax</i>	Sweetwater Marsh Unit
California pocket mouse	<i>Perognathus californicus</i>	Sweetwater Marsh Unit
Pacific kangaroo rat	<i>Dipodomys agilis</i>	Sweetwater Marsh Unit
Deer mouse	<i>Peromyscus maniculatus</i>	Sweetwater Marsh Unit
Dusky-footed woodrat	<i>Neotoma fuscipes</i>	Sweetwater Marsh Unit
Black rat	<i>Rattus rattus</i>	Sweetwater Marsh Unit
House mouse	<i>Mus musculus</i>	Sweetwater Marsh Unit
Coyote	<i>Canus latrans</i>	Both Refuge Units
Gray fox	<i>Urocyon cinereoargenteus</i>	Sweetwater Marsh Unit
Domestic dog	<i>Canus familiaris</i>	Both Refuge Units
Raccoon	<i>Procyon lotor</i>	Both Refuge Units
Long-tailed weasel	<i>Mustela frenata</i>	Gunpowder Point, Sweetwater Marsh Unit and South San Diego Bay Unit
Striped Skunk	<i>Mephitis mephitis</i>	Sweetwater Marsh Unit
Domestic Cat	<i>Felis domesticus</i>	Both Refuge Units

#### 3.4.4.3 Reptiles and Amphibians

A comprehensive survey of the reptiles and amphibians is not currently available for the San Diego Bay NWR, however, some limited data is provided in survey reports prepared by private consultants for various properties in and around the Refuge. One previous survey, conducted in 1990, included the uplands within and adjacent to the Sweetwater Marsh Unit (*Pacific Southwest Biological Services, Inc 1990*). This survey identified one native amphibian, the Pacific treefrog (*Hyla regilla*) and one exotic amphibian, the African clawed frog (*Xenopus laevis*). The African clawed frog was located in a brackish marsh, located near I-5. In addition, twelve native reptiles and one introduced lizard were identified. There were two notable reptiles, the California legless lizard (*Aniella pulchra*) and the coast horned lizard (*Phrynosoma coronatum blainvillei*). On the Sweetwater Marsh Unit, suitable habitat for the horned lizard is limited to Gunpowder Point; however, none have been observed there in recent years.

#### 3.4.4.4 Terrestrial Invertebrates

Very little information is available regarding the variety of terrestrial invertebrates (e.g. insects and spiders) occurring within the Refuge. The observations that have been recorded resulted from

directed searches for sensitive invertebrates within and surrounding the Sweetwater Marsh Unit. The results of these surveys are presented in Section 3.4.2.2.

#### **3.4.4.5 Exotic Wildlife Species**

Terrestrial exotic species occurring on the Refuge include rats, house mice (*Mus musculus*), European starlings (*Sturnus vulgaris*), house sparrows (*Passer domesticus*), opossum, and feral cats and dogs.

### **3.4.5 Species Assemblages in the Bay's Marine Community**

#### **3.4.5.1 Plankton and Algae**

Details regarding the various forms of plankton and algae observed in San Diego Bay are presented in sections 2.5.1 – 2.5.2 of the INRMP (*U.S. Navy 2000*). This information is incorporated into this CCP/EIS by reference.

#### **3.4.5.2 Marine Invertebrates**

The marine invertebrate population of these two Refuge Units is not well documented and additional research is needed. However, aquatic invertebrates of the bay and intertidal mudflats are generally well known. Invertebrates are considered an essential prey item for all species of shorebirds (*de Szalay no date*). Collectively, shorebirds forage in a wide variety of aquatic and terrestrial invertebrates, with different species relying on different feeding methods. Marine invertebrates are also an essential food source for marine fishes, waterfowl and other birds, and other invertebrate animals. Within the South Bay, there are a number of marine invertebrate communities, including benthic invertebrates, which are found primarily in the bottom sediments; epiphytic invertebrates, which are found on plant stems; and nektonic invertebrates, which are found swimming in the water column.

A study, conducted by the Pacific Estuarine Research Laboratory in June and October of 1989, identified 27 taxa of benthic (muddy bottom dwelling) invertebrates within the intertidal areas of the Sweetwater Marsh Unit. The dominant benthic invertebrate fauna observed during this survey were species of gastropods, polychaetes, and bivalves, of which the most abundant species were barrel shell (*Acteocina inclinata*), a species of polychate worm (*Polydora* sp.), and the jackknife clam (*Tagelus californianus*). Some additional discussion regarding the marine invertebrates observed within the Refuge is provided in Section 3.4.2.2. For a more detailed presentation about the invertebrates present within the different habitats of San Diego Bay, refer to section 2.5.3 (Invertebrates) of the INRMP (*U.S. Navy 2000*), which is incorporated by reference into this document.

#### **3.4.5.3 Fishes**

The San Diego Bay NWR includes areas identified as Essential Fish Habitat for various life stages of fish species managed under the Coastal Pelagics and the Pacific Groundfish Fishery Management Plans, as defined in the Magnuson-Stevens Fishery Conservation and Management Act (the Magnuson-Stevens Act). The waters within or adjacent to the Refuge are utilized by six species addressed in these Fisheries Management Plans (FMPs), including four of the five fish managed under the Coastal Pelagics FMP (northern anchovy (*Engraulis mordax*), pacific sardine (*Sardinops sagax*), pacific mackerel (*Scomber japonicus*), and jack mackerel (*Trachurus symmetricus*)) and two of the three species managed under the Pacific Groundfish FMP (California scorpionfish (*Scorpena guttata*) and English sole (*Parophrys vetulus*)).

When Congress amended the Magnuson-Stevens Act in 1996, it asserted in the Findings section of the Act that “one of the greatest long-term threats to the viability of commercial and recreational fisheries is the continuing loss of marine, estuarine, and other aquatic habitats. Habitat considerations should receive increased attention for the conservation and management of fishery resources of the United States (16 U.S.C. 1801 (A)(9)).” The Magnuson-Stevens Act, as amended, requires federal agencies undertaking permitting or funding activities that may adversely affect EFH to consult with the National Marine Fisheries Service (NMFS). The Act also requires Fishery Management Councils to amend all of their FMPs to describe and identify EFH for the fishery based on guidelines established by NMFS, to minimize to the extent practicable adverse effects on such habitat caused by fishing, and to identify other actions to encourage the conservation and enhancement of EFH.

An overview of the types of fish present within the tidal and intertidal areas of the San Diego Bay NWR was provided in Section 3.4.2.2.

#### **3.4.5.4 Exotic and Invasive Marine Species**

The introduction of exotic wildlife species, particularly benthic or epibenthic marine species, represents a serious threat to the health of San Diego’s coastal ecosystem (*U.S. Navy 2000*). Exotic marine species are transported into the bay environment on the exterior of ships, within ballast water that is discharged into the bay, and through illegal aquarium dumping. Some of the exotic species found in San Diego Bay include fishes such as sailfin mollies (*Poecilia latipinna*) and yellowfin goby (*Acanthogobius flavimanus*), which are believed to compete with native species for food and habitat. Another exotic, invasive species is the Japanese mussel (*Musculista senhousia*), which forms dense mats on substrata that alters sediment properties and may displace native bivalves. An exotic species that has invaded the salt marsh habitat of the Sweetwater Marsh Unit is the Australasian isopod *Sphaeroma quoyanum*. This organism burrows into the banks of the marsh’s tidal channels and along marsh edge habitat often in very high densities, resulting in increased bank erosion and loss of salt marsh habitat (*Talley et. al. 2001*).

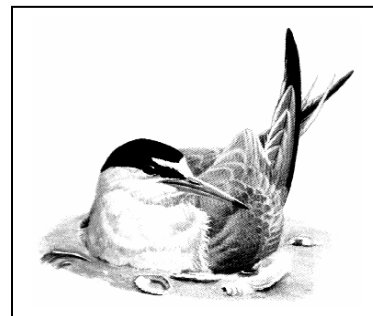
#### **3.4.6 Endangered and Threatened Species**

##### **3.4.6.1 Federally-Listed Species**

The federally-listed endangered and threatened species that utilize the habitats within the San Diego NWR are described below. This Refuge includes no Critical Habitat areas.

##### **California Least Tern (*Sternula antillarum*)**

The California least tern is the smallest of the tern species, measuring less than ten inches (about 23 centimeters) in length and weighing 45 to 55 grams. The total wing length is approximately four inches (110 millimeters) (*Massey 1976*). This subspecies has a short, forked tail, and a long, slightly decurved, tapered bill (*Sibley 2000*). Males and females are both characterized by a black cap, gray wings with black wingtips, white underbody, orange legs, and a black-tipped yellow bill.



California Least Tern

The California least tern breeds in the United States only along the immediate coast of California from San Francisco Bay south to the Mexican border. Unfrequented sandy beaches close to estuaries and coastal embayments had historically served as nesting sites for this species, but by the 1960s, suitable nesting

areas were severely reduced due primarily to coastal development and intense human recreational use of beaches. As a result, the tern's numbers diminished from uncountable thousands to several hundred by 1970, when the least tern was added to the Federal Endangered Species List.

Only a few beaches continue to support least tern nesting, including the Tijuana Estuary, Naval Amphibious Base Coronado, Naval Base Coronado (NAB Coronado, NBC), Santa Margarita River mouth, Huntington Beach, and Venice Beach. Terns have also recently returned to nest along a portion of beach in Ocean Beach near the mouth of the San Diego River. The majority of the least tern nesting areas now occur on manufactured substrates or fills, some of which were intentionally created to support tern nesting, while others were created for different reasons and inadvertently attracted nesting terns. Since 1970, nesting sites have been recorded from San Francisco Bay to Bahia de San Quintin, Baja California. The nesting range in California has apparently always been widely discontinuous, with the majority of birds nesting in southern California from Santa Barbara County south through San Diego County.

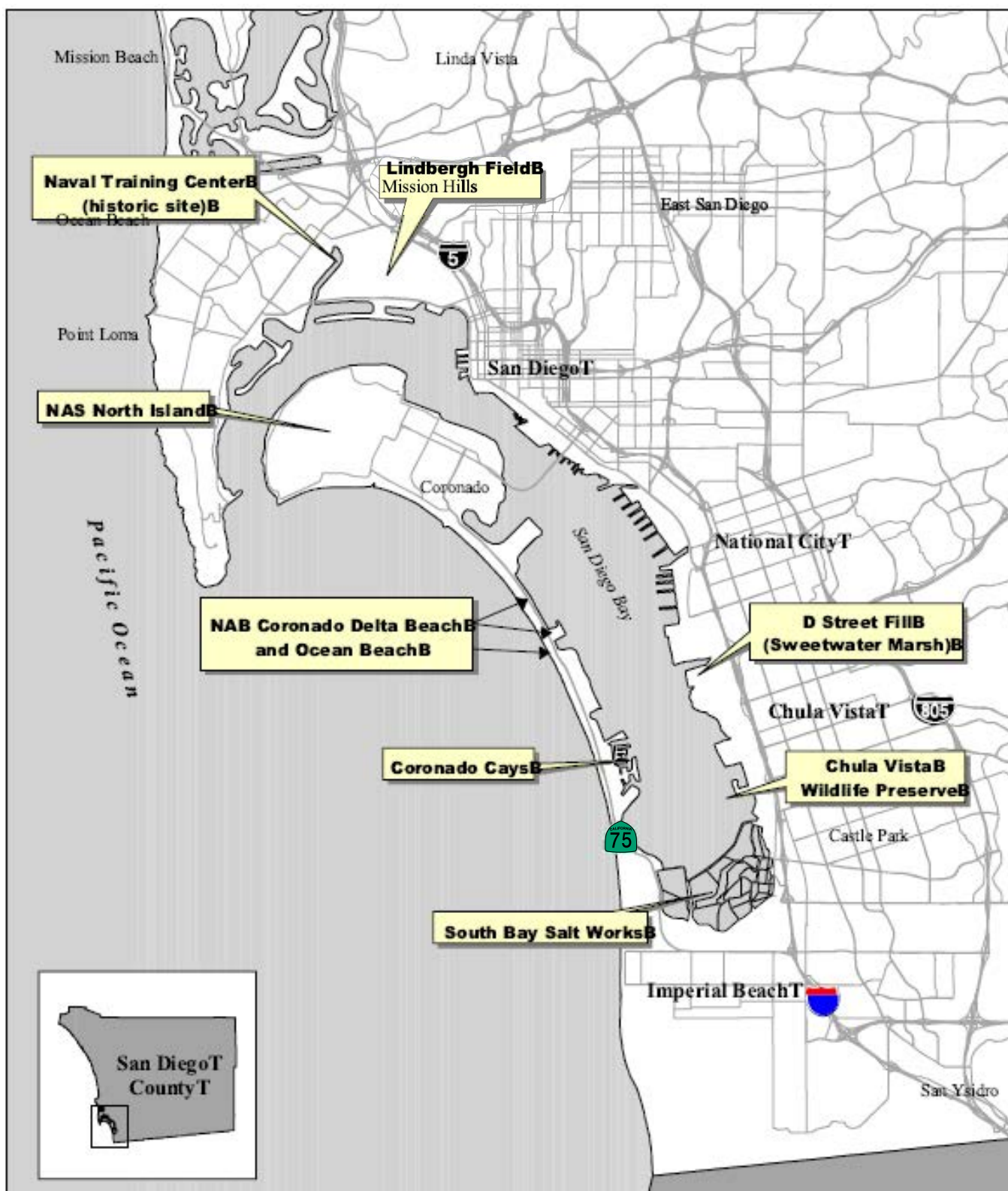
The loss of historic undisturbed "natural" breeding sites has forced least terns to adapt to a wide variety of alternatives; however, these alternative sites share several basic ecological requirements. Specifically, alternative sites must be relatively flat, open areas, with a sandy or dried mud substrate; relatively secluded from disturbance and predation; and in proximity to a lagoon or estuary with a dependable food supply (*Longhurst 1969, Craig 1971, Swickard 1971, Massey 1974*).

The California least tern is migratory, usually arriving in its breeding area in April and departing again in August. Least terns are colonial but do not nest in as dense a concentration as many other tern species. The nest is a simple scrape or depression in the sand, in which one to four eggs are laid, usually two. There is one breeding season, from May through August and only one brood is raised. However, the birds will re-nest if eggs or chicks are lost. Re-nesting often occurs from mid-June to early August, a time when 2-year-old birds also nest for the first time (*Massey and Atwood 1981*). Parents continue to feed their young even after they are strong fliers.

This tern species is an exclusive fish-eater, typically feeding on topsmelt, northern anchovy, gobies, and jacksmelt (*Massey 1974, Atwood and Kelly 1984*). Studies on fish dropped at nesting sites suggest that fish size, rather than species, is the essential requirement of suitable prey for the least tern. Feeding is carried out in the calm waters of narrow estuaries or large bays and for a short distance (i.e., usually within two miles [three kilometers] of the beach) in the open ocean. The hovering and plunging habits of this species are conspicuous. Adults that are not feeding young tend to go farther and feed on larger fish. After the eggs have hatched, however, the parents make shorter trips, bringing back smaller fish for their chicks. This need to locate smaller fish appears to result in the increased use of freshwater marsh systems, lagoons, and estuarine areas during the post-breeding dispersal phase, suggesting the importance of such habitats when juveniles are learning to fish.

Around San Diego Bay, there are six areas where least terns nest: Lindbergh Field, Naval Air Station North Island, NBC (NAS North Island, NBC), NAB Coronado, NBC (delta beach and ocean beach), D Street Fill (Sweetwater Marsh Unit), Chula Vista Nature Reserve, and the salt pond levees within the South San Diego Bay Unit (Figure 3-15).





**Figure 3-15T**  
**California Least Tern Nesting Locations in San Diego BayT**

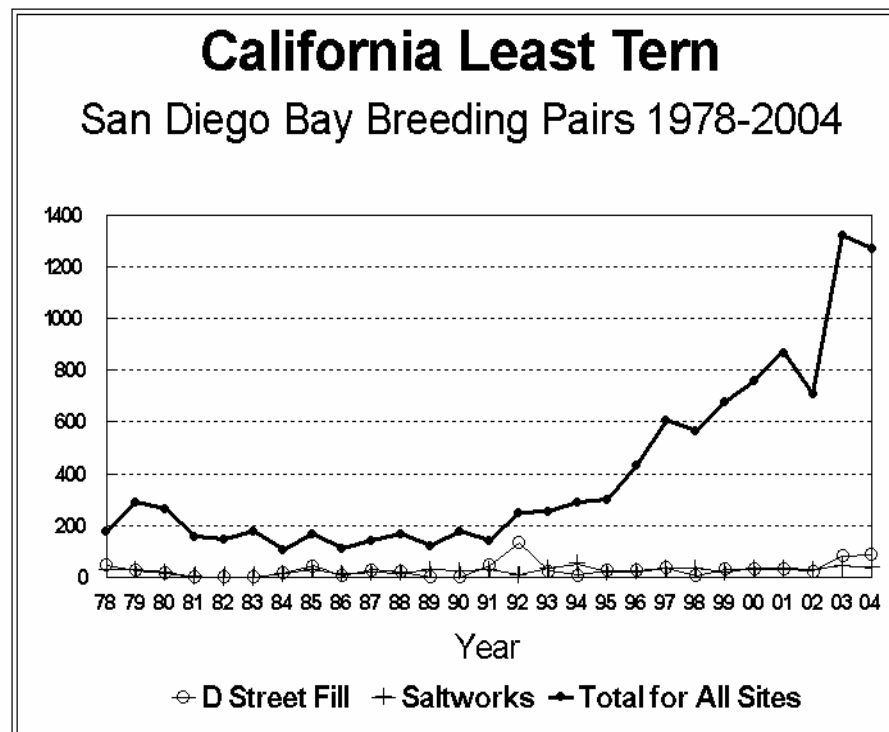
Source: California Spatial Information Library, SANDAG, Tele Atlas, USFWSd

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Least tern nesting occurred at the salt works for many years before there was any attempt to determine the total nesting population. The first documented count of tern nests occurred in 1968 when 60 pairs were observed nesting on the salt pond levees (*Craig 1971*). These nests were located primarily between Ponds 14 and 15, 13 and 25, and 24 and 27. Over the next two years, the numbers declined, with only two pairs observed in 1970.

Use of the nesting sites within the San Diego Bay NWR is regular; however, the number of least tern pairs utilizing the D Street Fill and salt pond levees has varied over the years (Figure 3-16). Despite increasing nest numbers, fledgling production at both sites has been fair to poor. In recent years, gull-billed terns nesting at the salt works have been observed preying upon least tern and snowy plover chicks at the salt works and elsewhere along the southern San Diego County coast line. Additional information regarding least tern nesting on the D Street Fill and the salt pond levees is provided in Section 3.4.4.1.

The least tern is vulnerable to a long list of predators, some of which are very abundant in urban environments, such as feral cats and dogs, crows, loggerhead shrikes, American kestrels, and other birds of prey. In San Diego Bay, young least tern chicks also fall prey to adult gull-billed terns which have been successfully nesting on the salt pond levees. To protect least tern nest sites from disturbance, ground access is typically controlled by fences or other obstructions. Nest site management involves three essential elements that if implemented may improve least tern reproductive success. These elements include protection from disturbance, management of predators, and surface preparation where weeds or excessive plant growth is a problem.

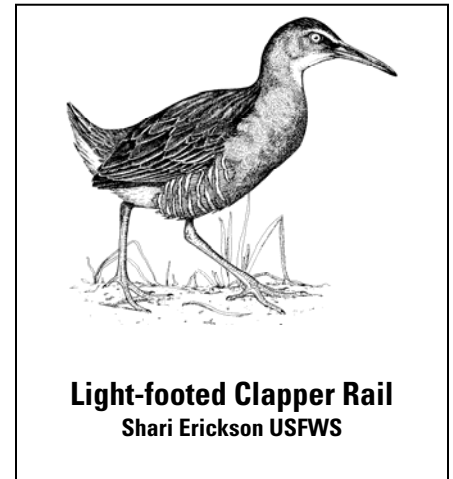


**Figure 3-16**

**Light-footed Clapper Rail (*Rallus longirostris levipes*)**

The light-footed clapper rail is a hen-sized marsh bird that is long-legged, long-toed, and approximately 14 inches (36 centimeters) long. It has a slightly down-curved beak and a short, upturned tail. Males and females are identical in plumage. Their cinnamon breast contrasts with the streaked plumage of the grayish brown back and gray and white barred flanks.

The light-footed clapper rail uses southern California coastal salt marshes, lagoons, and their maritime environs. The birds nest in the lower littoral zone of coastal salt marshes where dense stands of cordgrass are present. They also occasionally build nests in pickleweed. Light-footed clapper rails have also been known to reside and nest in freshwater marshes, although this is not common. They require shallow water and mudflats for foraging, with adjacent higher vegetation for cover during high water (Massey *et al.* 1984).



Light-footed clapper rails inhabit coastal marshes from the Carpinteria Marsh in Santa Barbara County, California, to Bahia de San Quintin, Baja California, Mexico. It is believed that most salt marshes along the coastline at one time supported clapper rails. However, recent census data indicate that less than 50 percent of the coastal wetlands in California are currently occupied. Southern California's largest subpopulation of these rails, located in the Upper Newport Bay, has been successfully reproducing since 1980. In contrast, the second and third largest subpopulations at Tijuana Marsh and Seal Beach NWR, are known to have undergone significant and episodic decreases in their numbers. At Seal Beach predation by mammalian and avian predators has periodically reduced the rail population. At Tijuana Slough, predation is also an important factor but the closing of the river mouth and subsequent cordgrass die-off was an environmental event that significantly affected the rail population present in the estuary at the time. All of the other subpopulations have exhibited more vulnerability to fluctuations in environmental conditions.

Very limited evidence exists for intermarsh movements by light-footed clapper rails. This subspecies is resident in its home marsh except under unusual circumstances. Movement within the marsh is also confined and generally of no greater spread than 1,300 feet (400 meters) (Zemba 1989). Minimum home range sizes for nine clapper rails that were radio-harnessed for telemetry at Upper Newport Bay varied from approximately 0.8 to 4.1 acres. The larger areas and daily movements were by first year birds attempting to claim their first breeding territories.

Light-footed clapper rails forage in all parts of the salt marsh, concentrating their efforts in the lower marsh when the tide is out, and moving into the higher marsh as the tide advances. Foraging activity is greatest in the early morning, while vocalizing shows a strong peak just before dark. Activities are also tide-dependent. The rails are omnivorous and opportunistic foragers. They rely mostly on salt marsh invertebrates, such as beetles (*Coleoptera*), garden snails (*Helix* spp.), California hornsnails, salt marsh snails (*Melampus olivaceus*), fiddler and hermit crabs (including *Pachygrapsus crassipes*, *Hemigrapsus oregonensis*, and probably *Uca crenulata*), crayfish, isopods, and decapods. This species may also forage on frog tadpoles (*Hyla* spp.), California killifish, and even

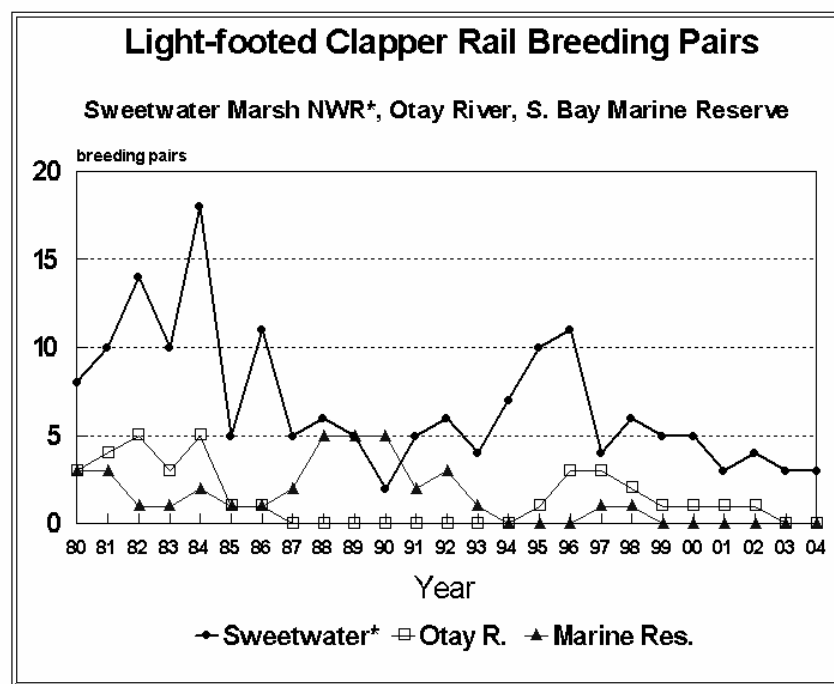
California meadow mice (*Microtus californicus*). The rails ingest some vegetable matter, including cordgrass stems and pickleweed tips, but this is uncommon.

The pair bond in light-footed clapper rails endures throughout the season, and often from year to year. Nesting usually begins in March and late nests have usually hatched by August. Nests are placed to avoid flooding by tides, yet in dense enough cover to be hidden from predators and support the relatively large nest. Females lay approximately four to eight eggs, which hatch in 18-27 days. Both parents care for the young. While one adult is foraging, the other adult broods the chicks. By the age of two days, chicks will accompany adults on foraging trips; however, adults have been observed feeding fully grown chicks of at least six weeks of age within 82 feet (25 meters) of their incubation nest.

Destruction of coastal wetlands in southern California has been so extensive that many estuaries where light-footed clapper rails were once abundant have been reduced to remnants. Although salt marsh habitat loss, degradation, and fragmentation are the leading threats to these rails, they are also threatened by disturbance, diseases, contaminants, and predation by non-native red foxes, feral cats, crows, and some raptors. The light-footed clapper rail was federally listed as endangered in 1970.

The light-footed clapper rail has been able to sustain a regular breeding presence in one or several of the pieces of tidal salt marsh that are near or part of the Sweetwater Marsh Unit and the South Bay Biological Study Area, and only sporadically in the lower reaches of the Otay River.

Surveys of the Otay River channel have periodically located nesting pairs of clapper rails between 1984 and 1998. In 1984, five nesting pairs were identified, while in 1998 only two pairs were located (Figure 3-17). The last clapper rail survey of the Otay River occurred in 2000, when only one nesting pair was detected.



**Figure 3-17**

### **California Brown Pelican (*Pelecanus occidentalis californicus*)**

The California brown pelican, which is one of six recognized subspecies of brown pelican, occurs along the Pacific Coast of the U.S. and Mexico, including the Gulf of California (*USFWS 1983*). Adults weigh approximately nine pounds (4 kilograms), and have a wingspan of over six feet (1.8 meters). They have long, dark bills with big pouches for catching and holding fish. Unlike other brown pelican subspecies, the California brown pelican typically has a bright red gular pouch during the courtship and egg-laying period. The California subspecies also has larger eggs.



The California brown pelican is still found in its original range, but California breeding colonies located in the Channel Islands National Park at West Anacapa Island and the Santa Barbara Islands continue to decline. This pelican also breeds on several islands off the coast of Acapulco, Guerrero, Mexico. Pelicans are ground nesting birds that typically build their nests with sticks. Nesting materials are brought to the female who builds the nest. All courtship takes place at the nest site. Normal clutch size is three eggs, which are laid in March or April. Both parents take turns incubating the eggs and rearing the chicks.

Brown pelicans can often be observed alternately flapping and gliding just over the tops of the breakers in a single file formation. They dive from flight to capture surface-schooling marine fishes and frequently plunge-dive from heights of up to 20-60 feet to capture fish. In California, brown pelicans feed primarily on Pacific mackerel, Pacific sardine and northern anchovy. Anchovies comprise 90 percent of their diet during the breeding season. Unfortunately, the northern anchovies and Pacific sardines on which the pelicans are so dependent have declined over the years due to overfishing.

The California brown pelican was listed as endangered in 1970 because of widespread pollutant-related reproductive failures. They are extremely sensitive to bioaccumulation of the pesticide DDT, which causes reproductive failure by altering calcium metabolism and thinning eggshells. Although California breeding populations have rebounded since the elimination of DDT use, DDT is still manufactured for export and its effects in the environment linger.

Adequate food availability is now a major concern for the long-term recovery of this species. Commercial over-harvesting of Pacific mackerel, Pacific sardine, and the northern anchovy has resulted in less food availability for these birds, particularly during the breeding season. Pelicans are also threatened by human development along the coast, which increases disturbance to these birds in their breeding and resting habitats. Pelicans are also at risk from discarded fishing gear, which can result in these birds becoming entangled in fishing line, and disease outbreaks resulting from overcrowding at roosting sites. Breeding populations and nesting productivity vary dramatically from year to year depending on El Niño events and other climatic changes.

The availability and quality of roosting and loafing areas also influence the energy budgets and reproductive potential of these birds (*Jagues and Anderson 1987*). These essential habitat areas are declining in California as development continues along the coast. This habitat is important for both breeding and non-breeding birds during the breeding season and particularly for the thousands of wintering migrants that occupy the coastal areas of the Southern California Bight during late summer and early fall (*Jagues and Anderson*

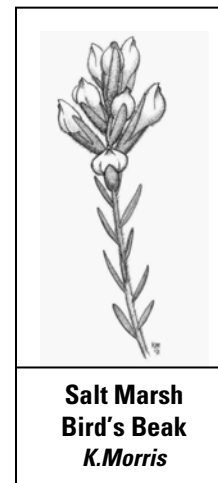
1987). Research suggests that roosts, like nesting areas, are selected to maximize the possibility of successful foraging while expending minimal energy (USFWS 1983). Floating objects in South San Diego Bay typically provide loafing locations for a few to many brown pelicans (USFWS 1995).

The San Diego Bay NWR provides year-round foraging and roosting habitat for non-breeding pelicans. These birds can occasionally be observed foraging along the tidal channels within the Sweetwater Marsh Unit, and more often foraging over the open waters of the South Bay. The salt pond levees on the South San Diego Bay Unit, particularly the levee that separates Ponds 10 and 11, appear to provide important roosting areas for non-breeding pelicans. Other roosting sites include the levee between Ponds 12 and 14 and the spit located just to the north of Pond 15. During the Service's 1993/1994 South Bay avian surveys, pelicans were occasionally observed foraging in the primary ponds (Stadtlander 1994).

#### **Salt Marsh Bird's Beak (*Cordylanthus maritimus maritimus*)**

Salt marsh bird's beak is an annual plant that typically grows in the upper elevations of tidal salt marsh habitat, but can also occasionally be found in nontidal salt marsh. Three bird's beak subspecies grow in the saline marshes of the western United States and Baja California, with the subspecies *Cordylanthus maritimus maritimus* occurring in the coastal marshes of northern Baja California and southern California from San Diego to Santa Barbara Counties.

Salt marsh bird's beak has an upright, branched growth form with an abundance of purple pigment in its tissues. The plants of San Diego County have bare pale cream-colored flowers. A hemiparasitic plant, salt marsh bird's beak is believed to derive water and perhaps nutrients through specialized root connections with other species (USFWS 1985). It is often found in association with pickleweed, shore grass, salt grass, Frankenia, and sea lavender. The plant occurs in well-drained/well-aerated soils that dry during the summer and where the only freshwater input is rainfall. Studies indicate that freshwater influence in the spring encourages germination and that salinities at the time of germination usually cannot exceed 12 ppt. Germination and flowering usually spans May to October but can sometimes occur during the winter. Pollination by upland, native bees is considered important to seed production, and yearly population numbers depend directly on seed dispersal and a site that provides the precise conditions required for germination.



Colonies of salt marsh bird's beak are found in only a few scattered salt marsh habitats between Santa Barbara and San Diego Counties. It is currently surviving at Carpinteria Marsh, Mugu Lagoon/Ormand Beach, Upper Newport Bay, Sweetwater Marsh, Naval Radio Receiving Facility (YMCA Surf Camp site), and Tijuana Slough. This species was listed as endangered in 1970 due to destruction and degradation of southern California's coastal salt marsh systems.

Within the Sweetwater Marsh Unit, salt marsh bird's beak has been observed in Paradise Marsh and Sweetwater Marsh. This species has not however been observed in the South San Diego Bay Unit. A directed search within Paradise Marsh for nine sensitive plant

species was conducted in 1998 for the City of National City. Salt marsh bird's beak, which was the only listed plant encountered during the survey, was identified in nine locations within Paradise Marsh, occurring primarily within the southwestern end of the marsh (*City of National City 1998*). The subpopulation also occurs within Sweetwater Marsh proper.

**Pacific Pocket Mouse (*Perognathus longimembris pacificus*)**

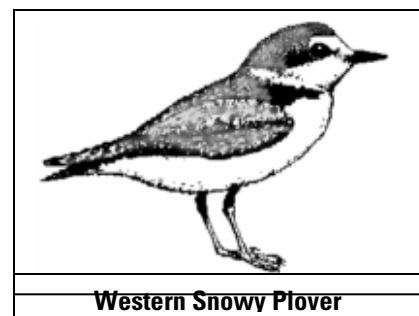
The Pacific pocket mouse is a small brownish rodent endemic to coastal southwestern California. It is a member of the rodent family Heteromyidae, which includes seed-eating kangaroo rats, kangaroo mice, and pocket mice. The Pacific pocket mouse is the smallest of the *Perognathus* genus and has a combined body and tail length of 120 millimeters and weighs between 6 and 10 grams. Only found only within 4 kilometers of the coast on fine-grained sandy substrates in coastal sage scrub, coastal strand, and river alluvium, this mouse once occurred from Los Angeles County south to the Mexican border. Now known from only three locations, the Pacific pocket mouse is one of the most endangered animals in the United States. In February 1994, this species was federally listed as endangered throughout its entire range.

Historically, the Pacific pocket mouse's range included the coastal areas from the Tijuana River north to Los Angeles County. However, due to habitat loss associated with development and ongoing human disturbance on many of the remaining open areas within its range, the distribution of the Pacific pocket mouse has been severely reduced. Although the upland areas within the San Diego Bay NWR are included within the historic range of this species, there is no recent record of its existence on the Refuge. In 1998, Tierra Environmental Services (2001) conducted a survey in the vicinity of the railroad right-of-way in proximity to the South San Diego Bay Unit to determine the suitability of the habitat for the Pacific pocket mouse. The site visit revealed the presence of compacted, silty soils that are not considered suitable habitat for this species. The potential for this species to occur within the Otay River floodplain or on Gunpowder Point is extremely low due to past agricultural activities, the proximity of urban development, and the presence of feral cats and exotic rodent species.

**Western Snowy Plover (*Charadrius alexandrinus nivosus*)**

The western snowy plover is a sparrow-sized, white and tan colored shorebird with dark patches on either side of the neck, behind the eyes, and on the forehead (*Page et al. 1995*). The coastal western snowy plover population is defined as those individuals that nest adjacent to or near tidal waters and includes all nesting colonies on the mainland coast, peninsulas, offshore islands, adjacent bays, and estuaries. The breeding range of the western snowy plover extends along coastal beaches from the southern portion of Washington State to southern Baja California, Mexico (*USFWS 1993*).

The breeding season of the western snowy plover extends from March 1 through September 15. Generally, 3 eggs are laid in a nest, which consists of a shallow depression scraped in sandy or saline substrates. Some nests are lined with plant parts, small pebbles, or shell fragments. Both sexes incubate the eggs for an average of 27 days (*Warriner et al. 1986*). Snowy plovers will renest after loss of a clutch or brood. Snowy plover chicks are precocial and leave the nest within hours of hatching in search of food. The tending adult(s) provide

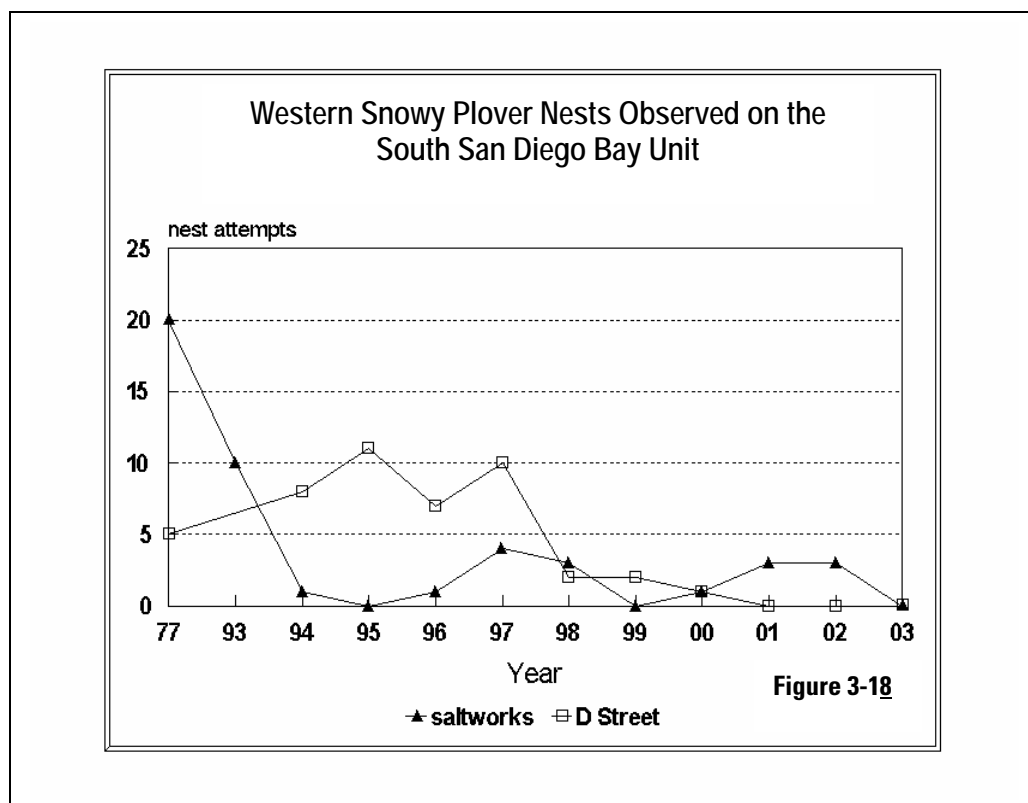




danger warnings, thermo-regulation assistance, and guide the chicks to foraging areas, but do not provide food to their chicks. Broods rarely stay in the immediate area of the nest. Young birds are able to fly within approximately 31 days of hatching (Warriner *et al.* 1986). Double brooding and the practice of one female having several mates have been observed. In addition, snowy plover females may abandon a nest before the chicks have fledged in search of another mate, leaving the male to care for the brood. Adults and young forage on invertebrates along intertidal areas, along beaches in wet sand and surf cast kelp, in foredune areas of dry sand above the high tide, on salt pans, and along the edges of salt marshes and salt ponds. The snowy plover is primarily a run and glean type of forager.

Human disturbance, predation, and inclement weather, combined with the loss of nesting habitat to urban development and the encroachment of introduced beachgrass (*Ammophila arenaria*), have led to an overall decline in the breeding and wintering population of the western snowy plover along the Pacific Coast. In southern California, the very large human population and resulting recreation activities have precluded the western snowy plover from breeding on historic beach strand nesting habitat. As a result of these factors, the Pacific coast population of the western snowy plover was federally-listed as threatened in 1993.

There are only a handful of snowy plover breeding locations currently used in southern California. Well used locations include Bolsa Chica (Orange County), Camp Pendleton, Batiquitos Lagoon, NAB Coronado, Silver Strand State Beach, Naval Radio Receiving Facility, and Tijuana Estuary in San Diego County. Within the San Diego Bay NWR, snowy plover nesting occurs most years at the salt works, but typically in very low numbers and with poor success (Figure 3-18). Snowy plover nesting has also been documented on the D Street Fill in the past; however, plover nesting has not occurred



there since 2000, when one nest was identified. Disturbance, predation, and inadequate access to foraging areas are the most likely reasons for this history of low nesting numbers and poor reproductive success. Additional information about plover nesting on the Refuge is provided in Section 3.4.4.1.

As with least terns, the list of potential predators of snowy plover eggs and chicks is long. Due to high densities in surrounding urban areas, corvids (crows and ravens), kestrels, and shrikes are likely to be significant threats to plovers on this Refuge. Gull-billed terns have also become a threat to this species during the nesting season.

### **Pacific Green Sea Turtle (*Chelonia mydas*)**

The Pacific green sea turtle is one of six species of sea turtles found in the oceans in and around the United States. This species grows to a maximum size of about 4 feet and a weight of 440 pounds. It has a heart-shaped shell, small head, and single-clawed flippers. Hatchlings generally have a black carapace, white underbody (plastron), and white margins on the shell and limbs. The adult carapace is smooth, keelless, and light to dark brown with dark mottling, with whitish to light yellow plastron. Hatchling green turtles eat a variety of plants and animals, but adults feed almost exclusively on seagrasses and marine algae.

Populations of the Pacific green sea turtle have seriously declined due primarily to direct take of turtles and eggs. The Pacific green sea turtle was federally listed as threatened in 1978 throughout its Pacific Range, except for the federally endangered population nesting on the Pacific coast of Mexico, which is covered under the Recovery Plan for the East Pacific green turtle. Increasing human populations and continued development along the coast, particularly development on or in proximity to nesting beaches, are serious threats to green turtle populations throughout the Pacific.

The green sea turtle has a worldwide distribution in tropical and subtropical waters and is generally found in fairly shallow waters (except when migrating) inside reefs, bays, and inlets. Open beaches with a sloping platform and minimal disturbance are required for nesting. Green turtles apparently have strong nesting site fidelity and often make long distance migrations between feeding grounds and nesting beaches.

Pacific green sea turtles appear to reside in the bay year round, although it is believed that individual turtles migrate in and out of the bay at various times. Although some believe the turtles are present in the Bay due to elevated water temperatures associated with the South Bay Power Plant, several researchers who have studied the bay's turtles since the 1980s concur that the bay's population of sea turtles is a natural population occurring at the northern end of their range (*Dutton and Stinson pers. comm.*). These researchers propose that the turtles are not present because of the warmer water, but because the eelgrass available in the bay represents the only foraging area within their range in which they are not at risk of being taken by poachers.

### **California Gnatcatcher (*Poliophtila californica californica*)**

The California gnatcatcher is a small, long-tailed bird that is a member of the thrush family (Muscicapidae). Its plumage is dark blue-gray above and grayish-white below. The tail is mostly black above and below. The male has a distinctive black cap that is absent during the winter. The coastal California gnatcatcher is one of three subspecies of the California gnatcatcher and is restricted to coastal southern California and northwestern Baja California, Mexico, from Los Angeles County (formerly Ventura and San Bernardino

Counties) south to El Rosario. The coastal California gnatcatcher occurs almost exclusively in the coastal sage scrub, although it is also occasionally found in chaparral.

The decline of this subspecies due primarily to habitat loss and fragmentation associated with development prompted the submittal of three petitions to list this species as endangered. A Final Rule was made on March 25, 1993 when the species was listed as threatened throughout its range.

Over the past two years, one to two California gnatcatchers have been observed vocalizing in the disturbed coastal sage scrub habitat occurring on Gunpowder Point within the Sweetwater Marsh Unit. No nests have been observed and no recent observations of this species have been made within the South San Diego Bay Unit.

#### **3.4.6.2 State-Listed Species**

Four of the federally listed endangered species supported by these Refuges, including salt marsh bird's beak, California least tern, light-footed clapper rail, and California brown pelican, as also listed as endangered by the State of California. The salt marsh habitat within these Refuges also supports the Belding's savannah sparrow, another species listed by the State of California as endangered.

##### **Belding's Savannah Sparrow (*Passerculus sandwichensis beldingi*)**

The Belding's savannah sparrow (Belding's) is one of four subspecies of savannah sparrows that are otherwise widely distributed and occur in a variety of habitat types, including grassland, high-elevation meadow, and marshes (AOU 1983; James and Stadtlander 1991). The Belding's savannah sparrow is unique in that it represents one of only two wetland-dependant avian species that reside year-round in the coastal salt marshes of southern California (Powell and Collier 1998). This salt marsh species is therefore reliant upon coastal salt marsh habitat for all of its life history requirements. This subspecies ranges along the southern California coast from Santa Barbara County (Goleta Slough) in the north to El Rosario, Baja California, Mexico in the south (James and Stadtlander 1991).

The Belding's savannah sparrow is a small brown sparrow with fine streaking on the head and face, pale beige to white belly, and often shows a dark central breast spot. As with most ground dwelling species, this bird is inconspicuous and blends well with its environment. The most distinguishing characteristic is the yellowish color of the lores (area between the bill and eyes) (Massey 1979). This subspecies generally nests within dense stands of pickleweed. Breeding territories can be very small and the birds nest semi-colonially or locally concentrated within a larger block of habitat (Zemba and Hoffman 2002).

The main factors that influence the long-term survivability of this subspecies are the health and security of its habitat. In southern California, the long-term protection of coastal salt marsh habitat is closely tied to ownership and use of the land. While threats to salt marsh habitat loss or degradation due to the direct impacts of urban development have slowed, the indirect impacts of intensifying development adjacent to areas of coastal salt marsh continue to increase. Human impacts, such as trespassing into closed areas, off-trail use in areas open to the public, and domestic and feral pets entering the marsh, continue to represent a serious threat to the long-term survivability of the Belding's savannah sparrow.

This subspecies was listed as endangered by the State of California in 1974 due to the development, degradation, and fragmentation of coastal salt marsh habitat as numbers of Belding's savannah sparrows were observed to have decreased dramatically (*Zembal et al. 1988*). The subspecies has no status under the Federal Endangered Species Act. Since State listing, many research studies have been completed on this species, including a life history study (*Massey 1979*), studies on habitat requirements (*USFWS 1986, Johnson 1987, Powell 1993*), research on the effects of habitat loss and fragmentation (*Powell and Collier 1998*), and various localized (e.g., *Zembal 1986, Kus 1990*) and rangewide surveys (e.g., *Bradley 1973, Zembal et al. 1988, James and Stadtlander 1991*).

Because of the secretive nature of this sparrow, it can be difficult to obtain accurate population estimates (*Zembal et al. 1988*). Census techniques consist of searching for territorial males in suitable habitat during the breeding season (late March through early July). Territorial behavior is ascertained through detection or observation of singing, scolding, aerial chases, nest-building, feeding young, or extended perching of individuals or presumed mates perching together in an area.

The Belding's savannah sparrow population estimate in California increased from 1,084 pairs in 1973, 1,610 pairs in 1977, 2,274 pairs in 1986, 1,844 pairs in 1991, 2,350 pairs in 1996, and 2,902 pairs in 2001 (*Zembal and Hoffman 2002*). However, statewide censuses of Belding's savannah sparrows reveal wide fluctuations in local population sizes, with local extirpations occurring in some years.

Belding's surveys conducted every five years since 1986 show a regular presence, but fluctuating numbers, within the San Diego Bay NWR (Table 3-16). Habitat fragmentation, disturbance/predation, and changing conditions within the marsh are contributors to these fluctuations. During the 2001 survey (*Zembal and Hoffman 2002*) identified 109 territories within the Sweetwater Marsh Unit, including seven in Paradise Marsh, 93 in Sweetwater Marsh, and nine at the F&G Street Marsh.

Table 3-16 Results of Five Breeding Pair Surveys for Belding's Savannah Sparrow on the San Diego Bay NWR					
Location	Number of Pairs				
	1977	1986	1991	1996	2001
<b><i>Sweetwater Marsh Unit</i></b>					
Paradise Marsh	16	19	14	6	7
Sweetwater Marsh	40	118	141	78	93
F&G Street Marsh	18	8	15	12	9
<b>Total for the Unit</b>	<b>74</b>	<b>145</b>	<b>170</b>	<b>96</b>	<b>109</b>
<b><i>South San Diego Bay Unit</i></b>					
Otay River Channel/Salt Works	100	70	29	71	102
South Bay Biological Study Area <sup>1</sup>	25	15	42	31	26
<b>Total for the Unit</b>	<b>125</b>	<b>85</b>	<b>71</b>	<b>102</b>	<b>128</b>

<sup>1</sup>The South Bay Biological Study Area is located within the approved boundary of the South San Diego Bay Unit, but outside the current management boundary.

Source: (*Zembal and Hoffman 2002*)

Ninety-eight territories were identified within the current management boundary of the South San Diego Bay Unit, with Belding's concentrated along the Otay River Channel, where 58 territories were observed. Another 27 territories were identified within the ribbon of pickleweed that grows along the outer levees of the salt works. Thirteen territories were identified within the drainage channel that flows through the salt works between Ponds 15 and 28. Within the approved acquisition boundary for the South San Diego Bay Unit, four territories were identified at the J Street Marsh, located just south of the Chula Vista Marina, and 26 territories were found at the South Bay Biological Study Area (Zemba and Hoffman 2002).

### **3.4.7 Species of Concern and Other Special Status Species**

#### **3.4.7.1 Birds of Conservation Concern**

The 1988 amendment to the Fish and Wildlife Conservation Act mandates the Service to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." The most recent effort to carry out this proactive conservation mandate is the approval of the Service's report, *Birds of Conservation Concern 2002*. The overall goal of the report is to accurately identify bird species at each geographic scale that represent Service conservation priorities and draw attention to species in need of conservation action. The bird species identified are primarily derived from prioritization scores from three major bird conservation plans: The Partners in Flight, U.S. Shorebird Conservation Plan, and North American Waterbird Conservation Plan (Kushlan et al. 2002). Birds included in the *Birds of Conservation Concern 2002* report are deemed priorities for conservation action. These lists are to be consulted in accordance with Executive Order 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds."

The 2002 report encompasses three distinct geographic scales: the Bird Conservation Regions (BCR) of the United States and Canada, and the cross-border BCRs agreed on with Mexico as part of the North American Bird Conservation Initiative; the USFWS Regions, which each consist of several states in the same geographic area, and the National List, which encompasses the United States, including U.S. island "territories" in the Caribbean and Pacific. Birds of Conservation Concern supported by the San Diego Bay NWR are included in the BCR 32 (Coastal California) List, USFWS Region 1 List, and the National List. Table 3-17 lists the Birds of Conservation Concern that are known to occur within this Refuge.

#### **Western Gull-billed Tern (*Gelochelidon nilotica vanrossemi*)**

The western gull-billed tern, which nests on the salt pond levees, is a species of particular concern both for its own status and for its choice of prey, which includes California least tern and western snowy plover chicks and eggs (Densmore 1990, Patton 2001, 2002, 2004b, and Molina and Marschalek 2003). The gull-billed tern is designated as a Bird of Conservation Concern at the national, regional (USFWS Pacific Region), and local scale (Southern Coastal California Bird Conservation Region). This tern was identified as a Bird of Conservation Concern because of declining population trends and threats to breeding birds. At the subspecific level, the western gull-billed tern is of increased concern due to its extremely small population size (less than 600 known nesting pairs range-wide), limited distribution (only 10 nesting sites range-wide), suspected population declines, and threats during the breeding season.

Over the past few years, gull-billed terns have benefited from the various recovery actions implemented on the Refuge to benefit the least tern and western snowy plover. These actions include protection of existing habitat areas, enhancement of nesting substrate,

**Table 3-17**  
**Birds of Conservation Concern Occurring within the San Diego Bay NWR**

Common Name	Scientific Name	Foraging Habitat(s)	Abundance	Included on BCC List		
				BCR 32	Region 1	U.S. <sup>1</sup>
Reddish egret	<i>Egretta rufescens</i>	Wetlands	Rare	No	No	Yes
Northern harrier	<i>Circus cyaneus</i>	Salt Marsh	Common	No	No	Yes
Swainson's hawk	<i>Buteo swainsoni</i>	Uplands	Rare	Yes	Yes	Yes
Ferruginous hawk	<i>Buteo regalis</i>	Uplands	Uncommon	No	No	Yes
Peregrine falcon	<i>Falco peregrinus</i>	Uplands, Salt Marsh	Occasional	Yes	Yes	Yes
Prairie falcon	<i>Falco mexicanus</i>	Uplands	Occasional	Yes	Yes	Yes
Pacific golden plover	<i>Pluvialis dominica fulva</i>	Intertidal	Rare	No	No	Yes
Whimbrel	<i>Numenius phaeopus hudsonicus</i>	Intertidal, <u>Salt Ponds</u>	Seasonally Common	Yes	Yes	Yes
Long-billed curlew	<i>Numenius americanus</i>	Intertidal	Common	Yes	Yes	Yes
Marbled godwit	<i>Limosa fedoa fedoa</i>	Intertidal, <u>Salt Ponds</u>	Common	Yes	Yes	Yes
Black turnstone	<i>Arenaria melanocephala</i>	Intertidal, <u>Salt Ponds</u>	Common	Yes	Yes	Yes
Red knot	<i>Calidris canutus</i>	Intertidal, <u>Salt Ponds</u>	Seasonally Common	Yes	Yes	Yes
Short-billed dowitcher	<i>Limnodromus griseus</i>	Intertidal, <u>Salt Ponds</u>	Common	Yes	Yes	Yes
Wilson's phalarope	<i>Phalaropus tricolor</i>	Salt Ponds, Intertidal	Common in July	No	No	Yes
Gull-billed tern	<i>Gelochelidon nilotica vanrossemi</i>	Intertidal, Uplands	Nests at Salt Works	Yes	Yes	Yes
Elegant tern	<i>Thalasseus elegans</i>	Open Water, Intertidal	Nests at Salt Works	Yes	Yes	No
Black skimmer	<i>Rynchops niger niger</i>	Open Water, Intertidal	Nests at Salt Works	Yes	Yes	Yes
Burrowing owl	<i>Athene cunicularia hypugaea</i>	Uplands	Historically Present	Yes	Yes	Yes
Short-eared owl	<i>Asio flammeus</i>	Uplands	Rare	No	No	Yes
Rufous hummingbird	<i>Selasphorus rufus</i>	Uplands	Common	No	No	Yes
Olive-sided flycatcher	<i>Contopus cooperi</i>	Uplands	Very Rare	No	Yes	Yes
Loggerhead shrike	<i>Lanius ludovicianus</i>	Uplands	Uncommon	Yes	Yes	Yes
Bewick's Wren	<i>Thryomanes bewickii</i>	Uplands	Common	No	No	Yes
Grasshopper sparrow <sup>2</sup>	<i>Ammodramus savannarum</i>	Grasslands	Uncommon	No	No	Yes
Tricolored blackbird	<i>Agelaius tricolor</i>	Wetland	Uncommon	Yes	Yes	Yes
Lawrence's goldfinch	<i>Carduelis lawrencei</i>	Uplands	Occasional	Yes	Yes	Yes

<sup>1</sup>National List <sup>2</sup> In Spring 2000, grasshopper sparrows were identified just to the east of the Sweetwater Marsh Unit in the disturbed uplands (Merkel & Associates, Inc. 2000).

Source: (USFWS 2002)

control of human disturbance, and removal of mammalian and avian predators that forage on the adults, chicks, and eggs of birds that nest on the salt pond levees. The benefits of these actions to the gull-billed tern appear to be reflected in the increase in the number of nesting pairs of this species that has been observed at the salt works since 1999.

An estimated 11 to 20 breeding pairs of gull-billed terns were present in 1999 (*Patton 2001*) and in 2004 approximately 40 breeding pairs were observed at the salt works (*Patton pers. comm.*). During this same period, the number of least tern and snowy plover chicks observed taken by gull-billed terns within the South San Diego Bay Unit, other sites around San Diego Bay, and the nesting areas at the Tijuana Estuary has also increased. The documented losses ranged from 10 in 1999 to at least 37 in 2003 (*Patton 2004b*). In 2004, a total of 43 least tern and snowy plover chicks were documented as lost to gull-billed tern depredation (*Patton pers. comm.*). Biologists monitoring the nesting populations around the bay and at the Tijuana Estuary infer that depredation by gull-billed terns on snowy plover and least tern chicks is ongoing when observers are not present, therefore, only a fraction of the predation is being observed. Based on the data, the impacts that gull-billed terns have had on the productivity of nesting sites throughout San Diego Bay and the Tijuana Estuary are not insignificant (*Brian Collins pers. comm.*).

Gull-billed terns are opportunistic feeders, preying on lizards, fish, insects, and on the chicks of shorebirds and other tern species. The first documented observation of gull-billed tern predation on a least tern chick occurred in 1988 in Mississippi (*Densmore 1990*). The loss of least tern and western snowy plover chicks by gull-billed terns has been documented at the San Diego Bay NWR since 1999 (*Patton pers. comm.*).

Gull-billed terns have been observed foraging along shoreline, dune, mudflat, and marsh edge habitats adjacent to San Diego Bay, including sites managed by the Refuge and the Navy, and within the Tijuana Estuary (*Patton 2004b*). In 1999, the primary prey of these birds appeared to be side-blotched lizards (*Uta stansburiana*) (*Patton 1999*), while observations made in 2001 and 2002 indicated that mole crabs (*Emerita analoga* and *Lepidopa californica*) and side-blotched lizards were the predominant prey items (*Molina and Marschalek 2003* and *Patton 2001*). Observation of this species continued in 2003 in an effort to increase our understanding of gull-billed tern foraging ecology around the bay.

During the 2003 nesting season, monitors documented a significant increase in least tern chick predation by gull-billed terns at the salt works and within the Tijuana Estuary (*Patton 2002*). A number of damaged least tern eggs were also attributed to suspected depredation by gull-billed terns. Of the prey observed taken by gull-billed terns at least tern and snowy plover sites adjacent to San Diego Bay and the Tijuana Estuary during the 2003 nesting season, 33 percent were chicks, 30 percent were crabs, 15 percent were lizards, and eight percent could not be identified, seven percent were insects, and seven percent were fish (*Patton 2004b*). These observations differ from the observations made during previous years. These differences may be attributed to the total number of chicks available in a given season or could relate to differences in the timing and location of data collection (*Patton 2004b*). In any event, at least 37 incidents of least tern and snowy plover chick predation by gull-billed terns were observed in 2003 (*Patton 2004b*).

The current situation has raised concerns that the gull-billed tern may be impeding the recovery of least terns and snowy plovers in San Diego Bay. Various programs within the



Service, including the Division of Migratory Birds Management, Refuges, and Ecological Services, are currently working together to identify and implement actions that will provide a better understanding of the current situation and its implications to all three species. Actions that are already being implemented include scientifically based monitoring on a limited scale at the salt works of gull-billed tern foraging activities. Limited monitoring of gull-billed tern nesting and reproductive success will also be implemented at the salt works during the 2005 nesting season.

The Service and biologists in Mexico are continuing to conduct surveys of gull-billed terns throughout its range. The initial results of the surveys completed in Mexico in 2003 were reported in Palacios and Mellink et al. (2003). Upon completion of the surveys, the results will be consolidated into a summary of the status and conservation needs of the western gull-billed tern. This information will not only help determine the population size of the western gull-billed tern, but will also provide insights into their habitat preferences and foraging needs. It will also assist the Service in determining the types of management actions, if any, that are necessary to conserve this species. Additionally, the data will permit a better assessment of how conservation of the gull-billed tern can be coordinated with endangered species recovery actions in Southern California.

#### **3.4.7.2 Species Covered by the Multiple Species Conservation Program (MSCP)**

The Multiple Species Conservation Program (MSCP) is a comprehensive habitat planning program for approximately 900 square miles in southwestern San Diego County. The MSCP addresses the potential impacts of urban growth, loss of natural habitat and species endangerment, and creates a plan to mitigate for the potential loss of species covered by the program. The intent of the MSCP is to protect interconnected blocks of different vegetation communities and habitat types in order to maximize protection of the region's most sensitive species. To achieve this goal, various habitat areas and connecting corridors were identified in a preserve. The need to consider the habitat requirements of 85 species of plants and animals (*City of San Diego 1998*) was essential to the design of the preserve.

It is the intent of the MSCP that local jurisdictions and special districts implement their respective portions of the MSCP through subarea plans, which describe specific implementing mechanisms for the MSCP. The combination of the subregional MSCP Plan and the required subarea plans serve as a multiple species Habitat Conservation Plan (HCP) pursuant to Section 10(a)(1)(B) of the Federal Endangered Species Act and a Natural Community Conservation Plan (NCCP) pursuant to the California Natural Community Conservation Planning Act of 1991 and the State Endangered Species Act. These subarea plans, which are intended to contribute collectively to the conservation of vegetation communities and species in the MSCP study area, form the basis for the contract, or "Implementing Agreement," between the local jurisdiction/special district and wildlife agencies (the Service and the California Department of Fish and Game).

In accordance with the MSCP, the City of San Diego has adopted a MSCP Subarea Plan. This plan established a Multi-Habitat Planning Area (MHPA) that is designed to address the needs of the indicator species described in the MSCP Plan and delineate core biological resource areas and corridors targeted for conservation. The southeastern portion of the South San Diego Bay Unit, specifically the salt ponds within the jurisdictional boundary of the City of San Diego and the Otay River floodplain, are included within the City of San Diego's MHPA (*City of San Diego 1997*).

The City of Chula Vista has also developed a MSCP Subarea Plan (*City of Chula Vista 2003*) that is intended to implement the MSCP Subregional Plan, including the habitat and species conservation goals and requirements. With the exception of Paradise Marsh, which is located

outside of the City of Chula Vista's jurisdictional boundary, the lands and waters within the Sweetwater Marsh Unit are included within the Chula Vista Subarea Plan's Habitat Preserve. Service approval of this Subarea Plan is still pending.

Of the 85 species covered by the San Diego and Chula Vista MSCP Subarea Plans, 29 have been observed or have the potential to occur within the San Diego Bay NWR (Table 3-18). For more information regarding the MSCP and the Subarea Plans, refer to Section 3.6.1.3.

<b>Table 3-18</b> <b>MSCP Covered Species Observed or Could Be Expected to Occur</b> <b>within the San Diego Bay NWR</b>			
<b>Common Name</b>	<b>Scientific Name</b>	<b>Habitat</b>	<b>Observed or Potential</b>
Aphanisma	<i>Aphanisma blitoides</i>	Southern foredunes, southern coastal bluff scrub	Unlikely potential for occurrence (SWM, SSDB)
Salt marsh bird's-beak	<i>Cordylanthus maritimus maritimus</i>	Coastal salt marsh	Observed (SWM)
Coast wallflower	<i>Erysimum ammophilum</i>	Southern foredunes, southern coastal bluff scrub	Unlikely potential for occurrence (SWM, SSDB)
San Diego barrel cactus	<i>Ferocactus viridescens</i>	Coastal sage scrub	Observed (SWM)
Nuttall's lotus	<i>Lotus nuttallianus</i>	Southern foredunes	Observed (SWM)
Snake cholla	<i>Opuntia parryi</i> var. <i>serpentina</i>	Maritime succulent scrub	Observed (SWM) Potential for occurrence (SSDB)
Salt marsh skipper	<i>Panoquina errans</i>	Coastal salt marsh (salt grass)	Observed at the D Street Fill (SWM), Potential for occurrence (SSDB)
San Diego horned lizard	<i>Phrynosoma coronatum blainvillei</i>	Coastal sage scrub, riparian scrub	Potential for occurrence (SWM, SSDB)
California brown pelican	<i>Pelecanus occidentalis</i>	Open water	Observed (SWM, SSDB)
Reddish Egret	<i>Egretta rufescens</i>	Coastal salt marsh	Observed (SWM, SSDB)
White-faced ibis	<i>Plegadis chihi</i>	Freshwater marsh, salt marsh	Observed (SWM, SSDB)
Canada goose	<i>Branta canadensis</i>	Wetlands, grasslands	Potential for occurrence (SWM, SSDB)
Bald eagle	<i>Haliaeetus leucocephalus</i>	Wetlands, open water	Potential for occurrence (SWM, SSDB)
Northern harrier	<i>Circus cyaneus</i>	Coastal salt marsh, coastal scrub, grasslands	Observed (SWM, SSDB)
Cooper's hawk	<i>Accipiter cooperii</i>	Coastal sage scrub	Observed (SWM, SSDB)
Ferruginous hawk	<i>Buteo regalis</i>	Grasslands	Rare Visitor (SWM, SSDB)
Golden eagle	<i>Aquila chrysaetos</i>	Uplands	Occasional Visitor (SWM, SSDB)
American peregrine falcon	<i>Falco peregrinus</i>	Coastal salt marsh, coastal sage scrub	Observed (SWM, SSDB)
Light-footed clapper rail	<i>Rallus longirostris levipes</i>	Coastal salt marsh	Observed (SWM, SSDB)

Table 3-18 (continued)

Common Name	Scientific Name	Habitat	Observed or Potential
Western snowy plover	<i>Charadrius alexandrinus nivosus</i>	Salt pan, beaches, salt works levees	Observed (SWM, SSDB)
Long-billed curlew	<i>Numenius americanus</i>	Coastal salt marsh	Observed (SWM, SSDB)
Elegant tern	<i>Thalasseus elegans</i>	Open water, beaches, salt pans	Observed (SSDB)
California least tern	<i>Sternula antillarum</i>	Open water, beaches	Observed (SWM, SSDB)
Burrowing owl	<i>Speotyto cunicularia</i>	Grasslands	Potential for occurrence, historically present (SWM, SSDB)
California gnatcatcher	<i>Poliopitila californica californica</i>	Coastal sage scrub	Observed (SWM) Potential for occurrence (SSDB)
Western bluebird	<i>Sialia mexicana</i>	Oak woodland, grasslands	Potential for occurrence (SSDB)
Belding's savannah sparrow	<i>Passerculus sandwichensis beldingi</i>	Coastal salt marsh	Observed (SWM, SSDB)
Large-billed savannah sparrow	<i>Passerculus sandwichensis rostratus</i>	Coastal salt marsh	Observed (SWM, SSDB)
Tricolored blackbird	<i>Agelaius tricolor</i>	Freshwater marsh, riparian scrub	Observed (SWM) Potential for occurrence (SSDB)
Townsend's western big-eared bat	<i>Plecotus townsendii</i>	Mesic habitats	Potential for occurrence (SWM, SSDB)
Mule deer	<i>Odocoileus hemionus fuliginata</i>	Uplands	Limited potential for occurrence in the Otay River floodplain (SSDB)

### 3.5 CULTURAL RESOURCES

#### 3.5.1 Introduction

Cultural resources have been identified within the boundaries of both the Sweetwater Marsh and South San Diego Bay Units. One of these sites, the salt works, has been determined to be eligible for listing in the National Register of Historic Places (NRHP), while other sites have yet to be evaluated. In addition, other cultural resources may be present within the Refuge that have not yet been identified.

Requirements for Federal agencies to identify, evaluate, and protect cultural resources are outlined in several Federal regulations (described in greater detail in Section 5.1.3 of this document), including the National Historic Preservation Act (NHPA) of 1966, as amended (PL 89-665; 50 STAT 915; 16 USC 470 et seq. 36 CFR 800). The NHPA sets inventory, nomination, protection, and preservation responsibilities for federally-owned cultural properties and directs Federal agencies to take into account the effects of their actions on items or sites listed or eligible for listing in the NRHP. The criteria used to evaluate eligibility to the NRHP, as contained in 36 CFR 60.4, include, among others, consideration of the quality of the property's significance in American history, architecture, archaeology, and culture and the property's known or likely ability to yield information important in prehistory or history. An historical property must also retain

the integrity of its physical identity that existed during the resource's period of significance. Integrity is evaluated with regard to the retention of location, design, setting, materials, workmanship, feeling, and association.

In accordance with the applicable cultural resource regulations, a preliminary overview of cultural resources within the Sweetwater Marsh and South San Diego Bay Units was prepared by the Service's Cultural Resources Team (*Speulda 2002*). This overview was prepared to assemble known information about the cultural resources located within and near the Refuge, to identify gaps in the existing data base, and to establish procedures for ensuring compliance with all applicable cultural resource regulations in the context of the CCP process. The findings of this overview are summarized in the sections that follow.

In February 2002 and June 2004, the federally recognized Tribes in San Diego County were contacted about the CCP process. Comments regarding the process and any concerns related to Tribal interests were solicited. No responses from the Tribes were received including any comments regarding traditional uses or the potential existence of sacred sites. Therefore, it is assumed that there are no known sites of interest to the Tribes within the Refuge boundary.

### **3.5.2 Overview of the Native American History and Landscape in San Diego County**

The earliest recognized period of California prehistory is referred to as Paleo-Indian. In the San Diego region this period is usually considered to date from at least 10,000 years before present until 8,500 to 7,200 years before present (*ASM Affiliates, Inc. 2003*). The sites that have been documented from this period are identified as belonging to the San Dieguito complex (*Tierra Environmental, Inc. 2001*). Flaked stone tools, such as knives, blades, and scrapers, suggest a hunter-gatherer society and the apparent absence of milling implements and ceramic from these sites suggests little or no use of seed grinding technology.

The Archaic period began at least 7,200 years ago, possibly as early as 9,000 years before present time (*ASM Affiliates, Inc. 2003*) and lasted until about 2,000 years ago. Sites from this time period are identified by some as belonging to the La Jolla Complex. This cultural tradition appears to have two distinct subdivisions in southern California. The first, found along the coastal areas of southern California, had an economy that relied largely on gathering wild resources, such as shellfish and seeds, along the coast, while further inland, hunting and gathering techniques were replaced with horticultural and agricultural techniques. During this phase, a reliance on seed and nut resources is suggested by the presence of grinding implements, such as manos and metates. Coastal sites from this period are frequently characterized by shell midden and fire hearths (*Tierra Environmental 2001*).

The Late Archaic, also referred to as the Late Prehistoric Period, is defined as about 2,000 years before present to Spanish contact (1769). This period is represented by the Yuman-speaking people from the Colorado River region, who migrated into southern California. This period is recognized archaeologically by small pressure-flaked projectile points and the use of mortars and pestles for grinding seeds and acorns. Archaeological evidence indicates that the manufacture and use of ceramic vessels for cooking, storage, and other uses began about 1,000 years ago.

At the time of European contact, a fairly large, stable population of Kumeyaay people occupied the region of southern California; they were direct descendants of the early Yuman hunter-gathers of the Late Archaic period. The Kumeyaay people lived in small groups within territories where they claimed only minor plant resources and eagle aeries. Acorns were an important food source for the Kumeyaay, along with upland game in the hills and fish and shellfish in coastal areas. The

Kumeyaay also practiced resource management and were proficient in many plant propagation methods. According to Kumeyaay Elder Delfina Cuero, as described in her autobiography, local Native Americans also gathered salt near the southern end of San Diego Bay for cooking and preserving fish and as a trade good for other tribes (*Gustafson and Gregory 2001*).

Displacement of Kumeyaay culture and society began at European contact. The introduction and development of the Mission system, and later the establishment of ranchos under the Mexican land grant program, all contributed to the disruption and break down of many Kumeyaay cultural institutions.

### **3.5.3 Early Euro-American History**

The first recorded exploration of San Diego Bay was conducted in 1542 by Portuguese explorer Juan Rodriguez Cabrillo, sailing under the Spanish flag. Sixty years later in 1602, Sebastian Vizcaino sailed into what is now known as San Diego Bay. It was not until 1769, however, that an overland party of missionaries, traveling north from Baja California, began the exploration and settlement of the region. This period, which extended from 1769 to 1821, is referred to as the Spanish Period. It is during this time that the San Diego Presidio and San Diego and San Luis Rey Missions were established.

In the 1770s, the land now included within the Refuge boundaries was part of La Purisima Concepcion, a grazing area for the mission herds. In 1795, the area was taken from the Mission by soldiers at the San Diego Presidio and renamed El Rancho del Rey. The land was then used to graze the horses and cattle for the presidio garrison.

In 1821, control of California passed from Spain to Mexico. This period, referred to as the Mexican Period, extended to 1848, when Mexico ceded California to the United States after the Mexican-American War of 1846-48. Following Mexico's independence from Spain, the missions were secularized and the large missions were divided and granted to individuals and families loyal to Mexico. This process became known as the rancho system of land distribution. The lands within the Sweetwater Marsh Unit were included within El Rancho de la Nacion, an area encompassing some 26,630 acres.

In 1848, Mexico ceded California to the United States and under the provisions of the Treaty of Guadalupe Hidalgo, residents of California were guaranteed property rights to land held in accordance with Mexican law. Acquiring title to these lands, however, was difficult. In 1851, Congress established procedures that would assist individuals in gaining clear title (a "patent") to these lands (*Crane 1991*). In 1866, President Andrew Johnson granted a land patent for the El Rancho de la Nacion (listed as National Ranch), and on June 15, 1868, the Kimball brothers purchased the National Ranch for \$30,000 (*Phillips 1962*). This land patent included six miles of bayfront in the vicinity of what is now National City (*EDAW 2001*).

Development of National City began slowly. In 1869, many individuals came to National City in hopes of working for the Memphis and El Paso Railroad, a project that did not materialize as promised. Between 1869 and 1873, the road connecting National City to the border was improved, a post office was established, and a wharf was constructed along the bayfront. Following a financial crash in 1873, which ended the current hopes for a railroad boom, the Kimball brothers turned to agriculture. Much of the area was used to raise sheep, grow wheat, and cultivate oranges, lemons, grapes, and olives (*Phillips 1962*).

In 1885, the vision of a railroad line connecting National City to other parts of California and beyond was realized with the completion of a line that connected National City to San Bernardino

(Bevil 1996). This was followed by the incorporation of National City in 1887. During that same year, the San Diego Land and Town Company, the syndicate controlled by the Santa Fe Railroad began construction of the Sweetwater Dam in order to promote land sales in National City and Chula Vista (Pourade 1964). Early in its history, Chula Vista was an agricultural center, known for its flowers, as well as its citrus and celery. Later, Chula Vista became a residential and industrial area and a center for aircraft parts manufacturing.

The Coronado Belt Line was completed in 1888. This railroad provided service from 5th and L Streets in San Diego, through National City and Chula Vista around the south end of the bay, and up the Silver Strand to Coronado. The railroad, which was originally owned by Elisha S. Babcock, Jr., H.L. Story, and associates, was built as part of the Coronado Beach development (Phillips 1956). The railroad was used to transport freight and passengers to and from Coronado. Regular passenger service on this line ended in 1896, but special excursion trains continued to operate for several years thereafter.

In addition to the community and agricultural development occurring in the mid to late 1800s in the vicinity of the area now included within the Sweetwater Marsh Unit, agricultural and industrial development was also occurring in and around lands and waters now included in the South San Diego Bay Unit. The history of solar salt production in the South Bay began in 1871 with the development of the La Punta Salt Works. This small-scale salt production facility was initially constructed on about 60 acres in the extreme southeast corner of San Diego Bay (*Union Tribune*, May 17, 1897). This facility subsequently closed and in 1902, Graham Babcock established the Western Salt Company approximately a quarter mile northeast of the extant La Punta Salt Works (Gustafson and Gregory 2001).

In 1911, when E.S. Babcock took over the Western Salt operation, he began purchasing much of the land along the south end of the bay in order to expand the facility. As the facility expanded, the historic salt marsh and intertidal mudflats were eliminated by the formation of diked evaporation ponds. By 1916, the facility extended across the entire end of the South Bay. A major flood severely damaged the facility in early 1916, but reconstruction began immediately and continued through 1918. In 1922, the facility was purchased by H.G. Fenton and remained under the ownership of H.G. Fenton Company until the majority of the salt works was incorporated into the South San Diego Bay Unit in 1999. Until recently, H.G. Fenton Company retained ownership over the southeastern-most bittern ponds within the salt works. These ponds, which were not included within the Refuge acquisition boundary, were subsequently sold to another property and will soon be removed from the existing salt works system.

During World War I, San Diego Bay became a Navy training ground and industrial complex. On Gunpowder Point, within the current boundaries of the Sweetwater Marsh Unit, the Hercules Powder Company built a 30-acre industrial complex to produce potash and acetone from sea kelp. The plant, which was constructed in 1916 and remained in operation until 1920, included 156 redwood “digestive” tanks, each eight meters in diameter and five meters tall. These tanks were used to ferment raw kelp for the primary purpose of producing potash, an ingredient of black powder, and acetone, an essential component used in the extrusion of cordite, a smokeless gunpowder used by the British armed forces (Nueshul 1991). The fermentation process also produced other marketable by-products including ethyl acetate and a number of solvents used for wartime purposes. When the war ended, the need for these products dwindled and the plant was closed.

Several of the powder company structures were later used by the Pacific Cottonseed Products Corporation to produce cottonseed oil. According to aerial photographs from 1936 and 1944, cottonseed oil production continued on the site until the mid 1940s.

From 1946 to 1986, Gunpowder Point was leased for agricultural purposes. During that time, the land was used to produce row crops, as well as hothouse tomatoes. Also during this same time period, the portion of the Otay River floodplain located within the South San Diego Bay Unit was in agricultural production. Although tomatoes were one of the primary crops grown in this area, the crop types did change as the market demand changed and as a result, over time a wide variety of irrigated row crops were produced at this site.

### 3.5.4 Archaeological Resources

The Service conducted a review of the records at the South Coastal Information Center and determined that archaeological investigations have taken place within the boundaries of and on parcels adjacent to both the Sweetwater Marsh and South San Diego Bay Units. Of the surveys and testing projects completed, there have been 15 archaeological sites recorded within or adjacent to these Refuge Units. The results of the surveys indicate that a variety of site types are present in the study area, including archaeological remains in the form of habitation sites, lithic scatters (stone flakes left behind from the process of making stone tools), shell middens, and temporary camps. The age of the prehistoric sites seem to relate to the early Archaic period through the ethnographic period.

Three recorded prehistoric archaeological sites are located within the Sweetwater Marsh Unit. These sites consist of a temporary camp (CA-SDI-4958), a lithic scatter (CA-SDI-5512), and shell midden (CA-SDI-7454). These sites were previously tested and evaluated for significance. None of the sites were determined to be eligible for the NRHP (*Speulda 2002*).

Six prehistoric sites and two sites containing both prehistoric and historic-period artifacts have been recorded on or near the South San Diego Bay Unit. Of the three sites that occur within the Refuge boundary, one site (CA-SDI-5513) has been determined not to be eligible for the NRHP, one site (CA-SDI-7455) has not yet been evaluated, and portions of another site (CA-SDI-4360) have been previously tested, but the resource as a whole has never been evaluated in accordance with Section 106 (*Pigniolo and Murray 2001*).

In the Historic Property Survey Report prepared for the Bayshore Bikeway Project, Pigniolo and Murray (2001a) provided the following comments regarding CA-SDI-4360:

*“Native American values have not been identified at the site but testing and data recovery efforts under CEQA [California Environmental Quality Act] at portions of the site have identified a variety of prehistoric cultural material (Apple 1982). This cultural material can address research questions related to subsistence, chronology, and environmental change. Portions of the site . . . still retain this research potential . . . CA-SDI-4360 is felt to be eligible for listing on the National Register under Criterion D at the local level of significance. No other National Register criteria are felt to apply to CA-SDI-4360.”*

In a letter to the Federal Highway Administration, dated May 28, 2002, the State Historic Preservation Office (SHPO) concurred that archaeological site CA-SDI-4360 is eligible for inclusion on the NRHP under Criterion D, as defined in 36 CFR 60.4.

A recent archaeological investigation conducted for the City of San Diego in association with the Otay River Pump Station and Conveyance System project identified site deposits considered to be



an extension of previously recorded site CA-SDI-7455. Based on artifacts and ecofacts recovered from a series of corings, three spatially distinct subsurface deposits were identified, including two dating to the Late Prehistoric period and one dating to the Archaic period (*ASM Affiliates, Inc. 2003*). These deposits were located at various depths below the surface, with the shallowest extending from about 70 to 150 centimeters below the surface and the deepest identified at a depth of approximately 500 centimeters below the surface. Based on the information gathered from this investigation, it is possible that additional cultural deposits exist below the surface that have not yet been located (*ASM Affiliates, Inc. 2003*). The features identified during this recent investigation have been recorded, but have not been evaluated for eligibility to the NRHP.

### **3.5.5 Historic Resources**

Historic research included an examination of various repositories and a review of the current listings for San Diego County on the National Register of Historic Places' website. Additionally, the California Inventory of Historic Resources (State of California), California Point of Historical Interest, and the California Historical Landmarks were consulted and historic photographs, historic maps, and vertical files of the San Diego County Historical Society Museum were examined.

Within the Sweetwater Marsh Unit, two sites containing historic artifacts have been recorded on Gunpowder Point. One of these sites contains both prehistoric and historic-period artifacts. Both sites have been tested and have been determined not to be eligible for the NRHP. The Hercules Gunpowder Company site, another site located on Gunpowder Point, has not yet been evaluated. Although the primary structures associated with this historic facility were dismantled many years ago, there are a number of historic features still remaining, including eight structural remnants.

Another historic site, the Coronado Belt Line Right-of-Way (CA-SDI-13,073H), occurs just outside of the Refuge boundary. This line when completed in 1888 extended for about 20 miles from central San Diego, through National City and Chula Vista, around the south end of the bay, and up the Silver Strand to Coronado. About 7.5 miles of the Belt Line remains today. Remnants of the original rail line exist along the east edge of the Sweetwater Marsh Unit and along the south edge of the salt works in the South San Diego Bay Unit, where the line was constructed on a berm, or elevated railroad bed, that crossed coastal salt marsh and mudflats. Although in disrepair, the two low trestles that were constructed to cross the channels of the Otay River can still be observed to the south of the salt works. The Coronado Belt Line right-of-way is not included within the approved acquisition boundary of the South San Diego Bay Unit; instead the right-of-way bisects the Refuge, with Refuge lands located to the north and south from about Saturn Boulevard in the City of San Diego to 12<sup>th</sup> Street in Imperial Beach.

In 1994, Caltrans with subsequent concurrence from the SHPO concluded that the railroad line did not possess the qualities necessary to be considered eligible for inclusion on the NRHP, nor was it determined appropriate for listing on the California Register of Historical Resources (*King 1994*). The eligibility of the line was reevaluated in 2001 by Dr. Karen Weitze as part of the environmental review process for the Bayshore Bikeway proposal. Once again, the line was determined to be ineligible for the NRHP due to the lack of integrity and lack of clarity of association (*Weitze 2001*). Also in 2001, Save Our Heritage Organization (SOHO) submitted a 7.5-mile segment of the Coronado Belt Line Right-of-Way (the segment that extends from National City to Imperial Beach) to the California State Historical Resources Commission (Commission) for consideration as a nominated resource to the California Register of Historical Resources (California Register). On February 2, 2002, the Commission voted to list the Coronado Belt Line Right-of-Way in the California Register. Following this decision, the Cities of San Diego, Imperial Beach, and Chula

Vista and the Port of San Diego sent letters to the State expressing their disagreement with the action to list the facility on the California Register and requesting that the Commission reconsider its prior determination. On November 8, 2002, the Commission considered the requests for redetermination and reversed their previous action. As a result of this action, the Belt Line Right-of-Way will not be included in the California Register.

The City of San Diego's Historical Resources Board (HRB) also considered this matter on several occasions and in December 2003 designated the Coronado Belt Line as a historic resource within the City of San Diego. The HRB concurred that the site was historically significant for its archaeological value. Among other factors, the HRB found that the Belt Line provided an example of the private capitalization of infrastructure and was representative of railroad construction in the late 1800s. The HRB's designation was appealed to the San Diego City Council in September 2004 at which time the Council approved the appeal and overturned the previous decision. This 2004 decision was once again reversed by the Council in 2005, resulting in the designation of the Belt Line as a historical site within the City of San Diego.

The other historic resource located within and adjacent to the South San Diego Bay Unit is the Western Salt Company Salt Works. Most, but not all, of the salt works site is located within the Refuge. The historic site includes the evaporation and crystallization ponds, as well as all of the buildings, structures, levees, and land necessary for the operation of the salt works. A Historic Resources Evaluation Report (*Gustafson and Gregory 2001*) was prepared for the Western Salt Company Salt Works in association with the Bayshore Bikeway proposal. The report includes the following statements regarding the significance of the site:

*"The Western Salt Company Salt Works has operated for nearly one hundred years. The unique location provides the Salt Works the elements that are necessary for successful solar salt production. The site consists of a grouping of related resources that are united by design and function. The Salt Works satisfies the requirements for a district under the National Register of Historic Places. The National Register defines a district as a site that "possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development."*

The report further states that the salt works, which retains a high degree of integrity, is eligible for inclusion on the NRHP under Criteria A and C of the National Register of Historic Places (36 CFR 60.4) because the facility played an important role in the solar salt industry in Southern California from 1916 to 1949 and the Salt Works embodies the distinctive characteristics of a solar salt processing facility.

The State Office of Historic Preservation in a letter to the Federal Highway Administration, dated May 28, 2002, concurred with the conclusions of the report and determined that the Western Salt Company Salt Works is eligible for inclusion on the NRHP. The contributing elements to the historic district include: the main processing plant, the pump house between Ponds 21 and 44, the electrical, generator and compressor buildings, the maintenance shop, the 18 condensing or evaporator ponds, the 14 crystallization salt ponds, the levees separating the condensing and crystallization ponds, the short section of narrow-gauge rail line as it crosses the San Diego & Arizona Eastern Railroad tracks, and the salt pile used for storage of salt after harvesting.

### **3.6 Social and Economic Environment**

The San Diego Bay NWR is included within the corporate boundaries of five cities: the Cities of National City, Chula Vista, Coronado, San Diego, and Imperial Beach. The portion of the

Sweetwater Marsh Unit situated to the north of the Sweetwater flood control channel is located within the City of National City, while the area to the south is located within the City of Chula Vista. The corporate boundaries within the South San Diego Bay Unit are somewhat more complicated, as illustrated in Figure 3-19.

### **3.6.1 Land Use**

This section presents an overview of the existing land uses that occur within and immediately surrounding the San Diego Bay NWR. Also presented are the relevant land use policies of the five municipalities that surround the Refuge and the other regional policies that affect land use in the immediate vicinity. Figure 3-20 illustrates the uses that occur within and adjacent to the Refuge.

#### **3.6.1.1 Current Uses on Each Refuge Unit**

##### **Sweetwater Marsh Unit**

The uplands within the Sweetwater Marsh Unit historically supported industrial and agricultural uses and the area in and around Paradise Marsh was the site of a municipal landfill where discarded waste was routinely burned. Today, however, the primary use on this Refuge Unit is open space/wildlife habitat. All of the lands and waters within the approved Refuge boundary for the Sweetwater Marsh Unit have been acquired as Federal land for inclusion in the National Wildlife Refuge System.

In addition to wildlife habitat, Gunpowder Point, located in the southwestern portion of the Refuge Unit, supports several wildlife-dependent recreational uses (described in more detail in Section 3.6.1.1), a 1,500 square-foot Refuge office, and the Chula Vista Nature Center. A gated road, which extends from the terminus of E Street through undeveloped private land, and onto the Refuge, provides access to the Refuge office and the Chula Vista Nature Center. This roadway crosses through the marsh on a narrow berm. No public access is permitted on the road except via a shuttle bus operated by the Nature Center. The shuttle bus transports visitors from a parking lot located near the E Street/I-5 interchange to the Nature Center, where they can explore the Nature Center and access the series of trails that extend across Gunpowder Point to the edge of the bay.

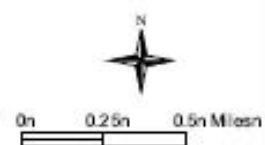
The Chula Vista Nature Center is situated on a 3.33-acre easement that was granted to the Redevelopment Agency of the City of Chula Vista in 1986 by the Santa Fe Improvement Company (the previous landowner of Gunpowder Point) for the purpose of constructing, operating, and maintaining a nature interpretive center. A license was also granted for access and utility purposes on the levee road. In 1988, as part of the Stipulated Settlement, the Court acknowledged the existing easement and license and required that the Santa Fe Improvement Company to convey Gunpowder Point to the Service subject to the easement and license previously granted to the City of Chula Vista.

The Nature Center includes indoor and outdoor exhibits that provide visitors with a better understanding of the history, geology, ecology, and natural history of San Diego Bay and the Sweetwater Marsh Unit. Interactive exhibits describe the biodiversity of the marsh, surrounding wetlands, and the bay, from intertidal mudflats to uplands. Interior exhibits are provided within a 12,000-square-foot facility. Exterior exhibits include a burrowing owl aviary, bird of prey enclosures, and an enclosed shorebird exhibit that includes two breeding pairs of light-footed clapper rails. The center also includes bird-watching platforms and gardens that focus on drought-tolerant plants. An eagle enclosure and a shark and ray exhibit are recent additions to the Center.



**Figure 3-19**  
**City Corporate Boundaries within the South Bay**

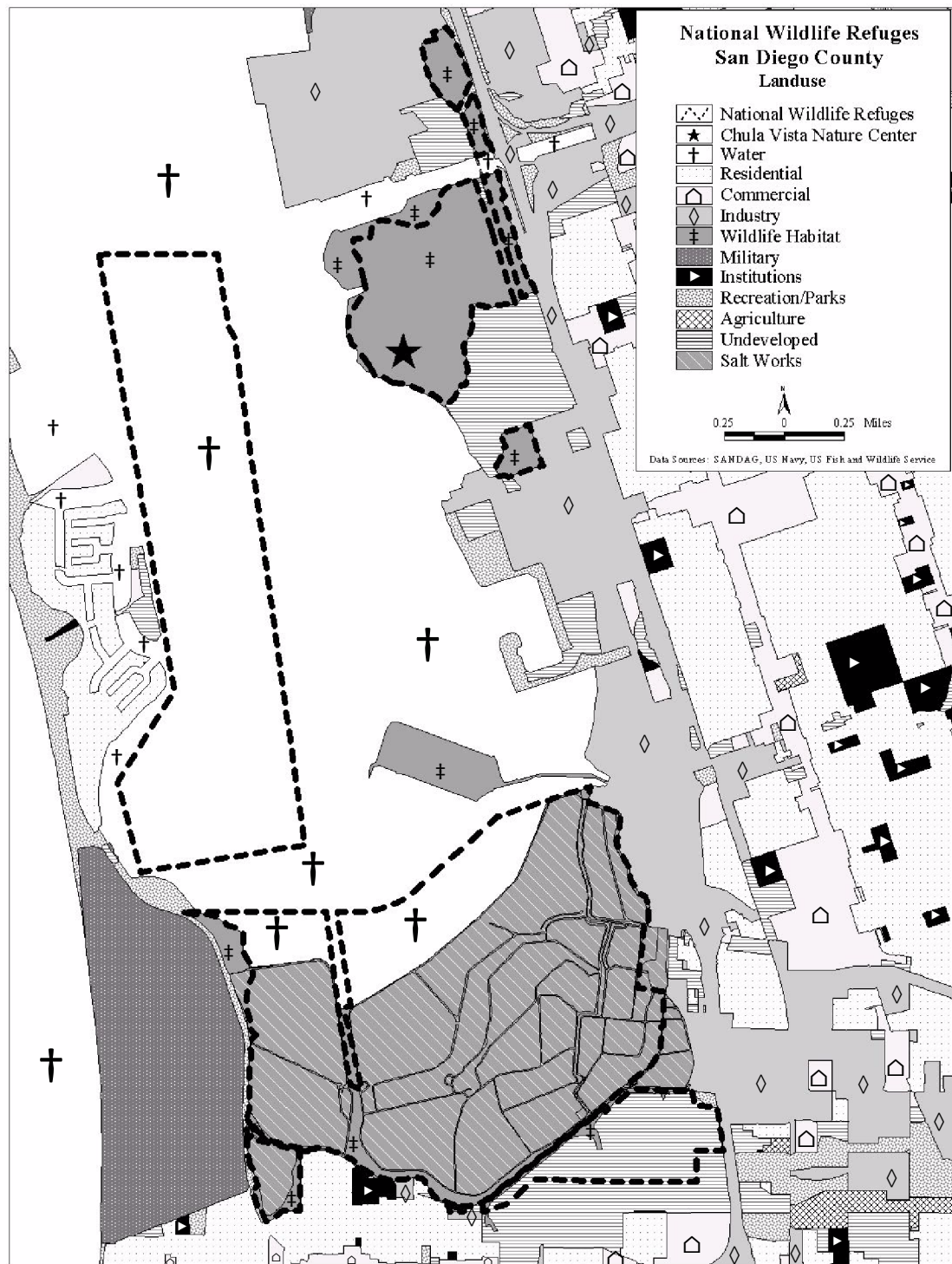
--- City boundaries
   South San Diego Bay Unit  
 Existing Management Authority



Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)

Carlsbad Field Office - 2003  
[http://www.usfws.gov/sanbay/fig\\_4-03/figures.apr](http://www.usfws.gov/sanbay/fig_4-03/figures.apr)





**Figure 3-20**  
**Land Use within and Surrounding the Sweetwater Marsh and South San Diego Bay Units of the San Diego Bay NWR**

### **South San Diego Bay Unit**

#### **Existing Uses within the Current Refuge Boundary**

Approximately 3,940 acres of land and water are included within the approved acquisition boundary of the South San Diego Bay Unit, of which approximately 2,300 acres are currently managed as part of the National Wildlife Refuge System. Of the areas already incorporated into the Refuge, the majority consists of open water within the southern end of San Diego Bay. This area provides habitat for wildlife, while also accommodating commercial and recreational water uses, such as boating, fishing, parasailing, and windsurfing. These open water areas, as well as the other submerged lands and tidelands within the Refuge's management area, are leased to the Federal government from the State Lands Commission, acting by and through the Service, for the creation and continued maintenance of a National Wildlife Refuge.

The portion of the South San Diego Bay Unit that is referred to as the Otay River floodplain is owned in fee title by the Service and is located within the southeastern portion of the Refuge. The primary use in this area is wildlife habitat. Public access is restricted to a recreational trail that traverses the area from north to south within a City of San Diego unimproved, dedicated street right-of-way (Saturn Boulevard). The majority of the trail is located outside the current Refuge boundary on land owned by the City of San Diego. A variety of underground and overhead public utilities also extend across the property, as described in Section 3.6.3.2. Some of these utilities are located within easements that were conveyed prior to the establishment of the Refuge, while others are included within dedicated street rights-of-way owned in fee title by another entity and are not included within the Refuge boundary (Figure 3-21).


The other major use within this Refuge Unit is the South Bay Salt Works, which occupies approximately 1,068 acres at the south end of San Diego Bay. The South Bay Salt Works is an active solar salt production facility that is operated in accordance with a Special Use Permit issued by the Service to the Airport Authority. The current operation produces between 60,000 and 80,000 tons of salt per year. In addition to salt production, the Special Use Permit also allows brine shrimp to be harvested from Pond 23; however, no brine shrimp harvesting has occurred in the past several years.


Although the majority of the salt works, particularly the salt ponds, are located within the Refuge, some elements of the salt operation are located on lands that were excluded from the approved Refuge acquisition boundary (refer to Figure 3-21). The excluded areas, which are owned by the Airport Authority, include Pond 40, a portion of Pond 42, and the land on which the salt processing plant and salt storage area are located. The Airport Authority also owns the processing equipment for the salt operation including the salt processing plant, conveyor, salt grinder, and other associated facilities. South Bay Salt Works currently has a lease with the Airport Authority to continue to operate the salt works until 2007. There is language in the Cooperative Agreement between the Port and Service that could permit the continuation of this use until at least 2009. The current operation also extends onto privately held lands, which are leased to the South Bay Salt Works by the private property owner. These privately held lands consist of the property currently occupied by Ponds 50 through 54, as well as property immediately to the east of the plant across Bay Boulevard. The lease on this property expires at the end of 2004 and will not be renewed. All salt works operations must be removed from this privately held property by June 2005.





**Figure 3-21**  
**Existing Ownerships Around the South San Diego Bay Unit**

 South San Diego Bay Unit  
 Existing Management Authority

 Undeveloped streets owned in fee title  
 by the City of San Diego

Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)

Carlsbad Field Office - 2003  
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### **Existing Uses Occurring Outside the Current Refuge Boundary, But Within the Approved Acquisition Boundary**

The Port has the responsibility for administering much of the area that is included within the approved acquisition boundary, but not currently included within the management boundary of the Refuge. In addition, the U.S. Navy owns property within the acquisition boundary and currently retains administrative authority for this area (refer to Figure 3-21).

Uses occurring within the acquisition boundary, but outside the current Refuge boundary include the South County Biological Study Area (Biological Study Area) and the Chula Vista Wildlife Reserve (Figure 3-22). The land occupied by the Biological Study Area is owned by the U.S. Navy and managed by the County of San Diego Parks and Recreation Department as a wildlife preserve and nature interpretive area. A parking lot, a segment of the Bayshore Bikeway, and coastal salt marsh habitat are included within the Biological Study Area. In 2003, the County of San Diego completed repairs to the parking lot and bikeway and installed new interpretive elements, an overlook, and benches along the edge of the marsh.

The Chula Vista Wildlife Reserve is a 55-acre habitat mitigation site that was built from dredged material obtained during the development of the Chula Vista Harbor. The Port retains management authority for this area and the Port Master Plan designates the site as a Habitat Replacement area. Public access to this area is prohibited.

Although the Port manages much of the land within the South Bay that is not located within the current Refuge boundary, these tidelands are owned by the State of California in trust for the residents of the state. The Port Master Plan (*SDUPD 1998*), which describes the uses permitted within this tidelands, designates the marshlands located to the south of J Street for preservation as wetlands (refer to Figure 3-20). The upland area immediately to the east of this marshland is designated Marine Related Industrial; however, the site is currently leased to Duke Energy for uses associated with the South Bay Power Plant. The Port also controls an area of shallow water and approximately 8.5 acres of vacant upland located immediately to the north of the Biological Study Area. This area is not currently leased for any use and is proposed in the Master Plan to be set aside and possibly enhanced for conservation purposes. The Port Master Plan recommends that limited water use associated with boating and fishing be permitted in the South Bay, and discourages the development of any other uses within the South Bay's shallow open water areas.

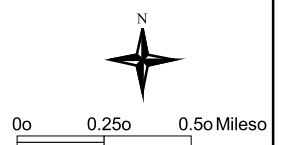
Another area included within the acquisition boundary, but not managed by the Service, is a 48-acre area of vacant land located at the southern end of the Otay River floodplain. This property is owned by the City of San Diego and is subject to the land use goals presented in the Otay Mesa Nestor Community Plan (*City of San Diego 1997*). This city parcel, as well as those salt ponds located to the east of the Otay River (with the exception of Ponds 15, 28 and 29 and the northern portion of 14), were incorporated into the Otay Mesa Nestor Community Plan area when the plan was adopted in 1997. These salt ponds are designated in the plan as open space, while the area to the south, including the Otay River floodplain and the City owned parcels to the south of the Refuge, are designated as a Special Study Area (SSA). The SSA overlay designation requires that all development proposals that are not consistent with the existing zoning on the property must include a Special Study that addresses biological resources, habitat value, and hydrology within the SSA. This information would then be used as a basis for determining appropriate land uses.



**Figure 3-22**  
**Land Uses Within and Around the South San Diego Bay Unit**

 South San Diego Bay Unit  
 Existing Management Authority

Source: USFWS, Local Agency Partnership 2000 (2 ft imagery)o



Carlsbad Field Office - 2003o  
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Although the Otay Mesa Nestor Community Plan also serves as the Local Coastal Plan for this area, the State Coastal Commission has designated the salt ponds and Otay River floodplain as a deferred certification area. As a result, a Coastal Development Permit must be obtained directly from the California Coastal Commission before any development can occur on the property.

### **3.6.1.2 Surrounding Land Uses**

#### **Sweetwater Marsh Unit**

##### **Existing Uses Surrounding the Sweetwater Marsh Unit**

Uses surrounding the Sweetwater Marsh Unit occur within the jurisdictional boundaries of the cities of National City and Chula Vista, while the Port is responsible for administering some of the areas immediately adjacent to the Refuge. In addition, the lands and waters in and around the bay, including those within the Refuge boundary, are included within the California Coastal Zone. Uses occurring in the immediate vicinity of the Sweetwater Marsh Unit include a container and bulk-handling port terminal, various industrial uses, and public recreation to the north and west; transportation corridors (a railroad right-of-way and I-5) to the east; and recreational boating and other bay related uses to the west. Paradise Marsh, which extends to the north of the main Refuge area, is situated between I-5 to the east and an existing railroad right-of-way to the west. Surrounding Paradise Marsh to the north and west are industrial and public recreation uses within National City.

The majority of this Refuge Unit is located to the south of the Sweetwater Channel in the City of Chula Vista. The lands located immediately to the east and southeast of Sweetwater Marsh are currently vacant, as is the property to the north and west of the F&G Street Marsh. Industrial uses about F&G Street Marsh to the south and east and vacant land and marine related industry occurs to the southwest.

##### **Potential Future Development around the Sweetwater Marsh Unit**

Future development and/or redevelopment adjacent to the Paradise Marsh portion of the Refuge would occur in accordance with the City of National City's Harbor District Specific Area Plan (*City of National City 1998*). This Specific Area Plan, which encompasses both the General Plan recommendations for the area and Local Coastal Program requirements, covers the lands located between 24<sup>th</sup> Street in National City south to the Sweetwater Channel and west from I-5 to the Burlington Northern Santa Fe Railroad. Although Paradise Marsh is not under National City coastal development permit authority, it is included within the boundaries of the plan and the plan incorporates development standards intended to protect the visual and biological quality of this resource. The approved land use designations for the other properties within this area include tourist commercial use for the 8.3 acres located on the bluff immediately to the north of Paradise Marsh and tourist commercial use and a limited area of medium industrial use to the west.

The mudflats that border the western edge of the Refuge, as well as the western and northern edges of the D Street Fill, are located outside of the Refuge boundary and are managed by the Port. The Port Master Plan (*SDUPD 1998*) designates the western end of the D Street Fill, the area located beyond the Refuge boundary for Habitat Replacement, while the northern edge is designated for Marine Services. The Master Plan states that the mudflats that extend from the Sweetwater Flood Control Channel to about G Street will be preserved as wetlands.

The private lands to the south and southeast of Sweetwater Marsh are regulated by the City of Chula Vista in accordance with the Chula Vista General Plan, Chula Vista Local Coastal Program Bayfront Specific Plan, and Bayfront Redevelopment Plan. The Chula Vista General Plan (*Chula Vista 1995*) currently designates the vacant property immediately to the south and southeast for park and recreation. Beyond this parkland designation, the General Plan designates multi-family use with visitor-serving commercial located adjacent to I-5. The area immediately to the north of the F&G Street Marsh is designated for retail development. In September 2002, a development proposal was submitted to the City of Chula Vista for this area that would require the approval of an amendment to the General Plan, Local Coastal Plan, and Redevelopment Plan. This proposal, as originally submitted, envisioned the construction of 6.4 million square feet of mixed-use development in a series of multiple story buildings, including several high-rise residential structures. These plans are currently on hold, as the developer works with the City of Chula Vista and the Port on proposals for the City of Chula Vista Bayfront Redevelopment Project. Preliminary land use proposals for this area as a result of the current redevelopment planning effort include office and resort hotel use. The specific land uses ultimately approved for the area immediately adjacent to the Refuge will depend upon which development proposal is ultimately adopted by the City of Chula Vista and the Port for the Bayfront redevelopment area.

Immediately to the south of the F&G Street Marsh is the Goodrich industrial site. The uses on the Goodrich site are not expected to change in the near future. Most of the properties to the south and west of the Goodrich site are included within the Bayfront redevelopment area and are currently designated as Industrial Business Park in the Port Master Plan (*SDUPD 1998*). The Industrial Business Park allows industrial, commercial retail, hospitality, and related uses in a planned development concept. However, the future use of this area is currently being reevaluated as part of the Bayfront redevelopment planning process. It is likely that following the adoption of a Redevelopment Plan, development intensities in this area will be significantly greater than currently permitted in the Port Master Plan.

In 2001, the Port approved an amendment to the Port Master Plan that redesignated the area located to the southwest of the F&G Street Marsh, a total of 15.4 acres, from Marine Related Industry to 10.9 acres of Commercial Recreation and 4.5 acres to Habitat Replacement Conservation. The new Habitat Replacement Conservation designation abuts the F&G Street Marsh to the southwest and provides a buffer between the Refuge land and the Commercial Recreation area further to the southwest (*SDUPD 2001*). As a condition of this Port Master Plan Amendment, the Port was required to enter into a cooperative agreement with an appropriate agency or organization, which would be designated to protect and/or enhance, where appropriate, the 210 acres of mudflats that abut the western edge of the Refuge (*SDUPD 2001*).

### **South San Diego Bay Unit**

#### **Existing Uses Surrounding the South San Diego Bay Unit**

A wide variety of uses occur on the lands and waters beyond the acquisition boundary of the South San Diego Bay Unit, including developed and undeveloped Port lands, wildlife habitat areas, and an array of industrial, commercial, military, residential, and recreational uses. From north to south, uses include commercial and recreational boating and some fishing immediately to the east and west from the northern edge of the acquisition boundary to the north end of the Coronado Cays. To the west along the Coronado Cays,

the Refuge is bounded by a dredged channel that provides boating access to the Cays, a hotel development further to the west, residential development, limited water related commercial, parkland, and additional residential development, all regulated by either the Port or the City of Coronado. To the east within the City of Chula Vista, the Refuge is bounded by a dredged channel that provides boating access to the Chula Vista Marina; further east it is bounded by the Chula Vista Bayfront Master Plan Area, which includes the South Bay boatyard, Bayside Park, the Chula Vista Marina, Bayfront Park, and the South Bay Power Plant.

The South Bay Power Plant, located to the northeast of the salt ponds, is a gas- and oil-fueled generating plant with four major steam cycle units. Bay water is the primary component of the plant's circulating cooling water system. The plant takes in water from the bay through a channel constructed to the north of the Chula Vista Wildlife Reserve and discharges the heated water just to the north of the salt works. There have been various discussions regarding the future of this plant, from decommissioning the plant and constructing a new plant somewhere else in the region, to more recent discussions of decommissioning the existing plant and constructing a more efficient plant slightly to the south of the current site.

The area to the east of Pond 29 supports various light industrial facilities within the City of Chula Vista. Further to the south, across the street from the salt plant, the land uses include a combination of industrial and residential uses. Some of this property is included within the City of Chula Vista, while other areas are located within the City of San Diego.

The Navy owns the land to the north and west of Ponds 10 and 11, as well as a small portion of the northwest corner of Pond 11 and the westernmost end of the northern levee of Pond 11 (Figure 3-21). This area, which is located to the south of the Coronado Cays in the vicinity of Emory Cove, includes uplands and some wetlands and is used primarily for military training operations. The Naval Radio Receiving Facility, Naval Base Coronado (NRRF), located further to the south is also used for military training operations and other Navy related activities. Other military lands in the vicinity of the Refuge include Naval Base Point Loma, Naval Station San Diego, Naval Base San Diego, Naval Air Station North Island, Naval Amphibious Base Coronado, and Naval Base Coronado.

Community commercial development and a mobile home park are located within the City of San Diego, to the south of the Otay River floodplain and outside of the acquisition boundary. A sewer pump station operated by the City of San Diego's Metropolitan Wastewater Department is located further to the west. Beyond the pump station to the west is Pond 20A, which although located within the jurisdictional boundaries of the City of San Diego and is owned and managed by the Port (refer to Figure 3-21). Pond 20A was once a part of the salt making operation to the north, but is no longer connected to the system. The northern portion of this pond is included within the Refuge management and acquisition boundary, while the southern end of the pond is located outside the acquisition boundary. Redevelopment of the southern end of this pond has been considered in the past, but at present no specific proposals are being considered.

To the southwest of the Refuge, within the City of Imperial Beach, surrounding uses include residential development, a few light industrial uses, an elementary school, a public works yard, and a mobile home park. The Imperial Beach General Plan (1994) describes this area as the Bayview Neighborhood, and identifies the Imperial Beach bayfront as unique and environmentally sensitive. The General Plan encourages the evaluation of



opportunities for increased public access to the bay, including a marina or other commercial recreational marina alternatives. The Plan also supports the creation of a recreational corridor along the Imperial Beach bayfront incorporating bicycles and pedestrian paths and suggests that additional public access be provided to the bayfront.

#### **Potential Future Development around the South San Diego Bay Unit**

As described previously, the City of Chula Vista and the Port are currently developing plans for the Bayfront Redevelopment area that could change the types of uses currently occurring to the east of the South San Diego Bay Unit. The redevelopment area extends from about the F&G Street Marsh in the Sweetwater Marsh Unit to the south end of the South Bay Power Plant site. Preliminary proposals envision a significant increase in the intensity of uses occurring in the vicinity of the Chula Vista Marina, to the east of the J Street Marsh, and within the existing power plant property. The plans also propose to improve public access to the bay and could result in the development of residential uses adjacent to some portions of the Refuge.

The property currently occupied by Ponds 50 through 54 is currently being considered for development as part of another redevelopment planning effort to the south of the Bayfront. This smaller redevelopment area includes most of the properties to the east of the salt works and west of I-5 between Palomar Street and Main Street. Although no specific development plans have been released, preliminary planning indicates that this area could be proposed for community commercial, multi-family residential, and/or mixed use development. The property is currently located within the jurisdictional boundaries of the City of San Diego; however, the cities of San Diego and Chula Vista have been discussing the possible reorganization of their boundaries, which could lead to the annexation of this area into the City of Chula Vista.

Another potential future redevelopment site is the 17-acres of the salt works owned by the Airport Authority. The Airport Authority currently leases this property to the South Bay Salt Works. That lease expires in 2007. The Airport Authority would then have the option to renew the lease, lease the property to another party, or sell the property. No information is currently available regarding the types of uses, if any, that could potentially be proposed for this site in the future.

#### **3.6.1.3 Regional Habitat Conservation Planning**

The MSCP is a comprehensive habitat conservation planning program that addresses multiple species habitat needs and the preservation of native vegetation communities in southwestern San Diego County (*City of San Diego 1998*). Both the Sweetwater Marsh and the South San Diego Bay Units are included within the MSCP study area. Sixteen core biological resource areas and associated habitat linkages were identified in the MSCP study area; these include the South San Diego Bay/Silver Strand core resource area and the Otay River and Sweetwater River habitat linkages, portions of which occur within the boundaries of the Sweetwater Marsh and/or the South San Diego Bay Units.

The MSCP was developed cooperatively by affected local jurisdictions and special districts with the goal of conserving native vegetation communities and associated species, rather than focusing preservation efforts on one species at a time. Local jurisdictions and special districts are to implement their respective portions of the MSCP Plan through subarea plans, which describe specific implementing mechanisms for the MSCP. The subarea plans will contribute collectively to the conservation of vegetation communities and species in the MSCP study area. The

southeastern portion of the South San Diego Bay Unit is included within the City of San Diego's MSCP Subarea Plan (*City of San Diego 1997*), while the Sweetwater Marsh Unit is included within the City of Chula Vista MSCP Subarea Plan (*City of Chula Vista 2003*).

The Chula Vista MSCP Subarea Plan (*City of Chula Vista 2003*) includes the Sweetwater Marsh Unit within the area identified as Habitat Preserve and addresses the Refuge in several places, particularly in the discussion of covered species. Despite the inclusion of the Refuge within the Subarea Plan, the management and maintenance of Refuge property remains the responsibility of the Service. The Subarea Plan goes on to state that buffers outside the Refuge boundary, as well as lighting and water quality controls, will be required as part of the land use controls within the Chula Vista LCP to reduce the effects of adjacent development on sensitive Refuge habitats. The Framework Management Plan of Chula Vista's MSCP Subarea Plan includes a number of management directives that represent the management requirements of the Habitat Preserve. Particularly relevant are the adjacency management issues, which address illegal intrusions into the Preserve, the need to install barriers and/or signage in new communities to properly direct public access, and adjacency guidelines for all new development. These guidelines address drainage, lighting, noise, invasive plants, and the need for public outreach.

The City of San Diego MSCP Subarea Plan (*City of San Diego 1997*) includes the southeastern portion of the South San Diego Bay Unit within its MHPA. The MHPA delineates core biological resource areas and corridors targeted for conservation. The portion of the Refuge included within the MHPA is that portion of the salt works situated within the jurisdictional boundaries of the City of San Diego, as well as western end of the Otay River floodplain. The City of San Diego's Subarea Plan was prepared prior to establishment of the South San Diego Bay Unit; therefore, it is not entirely accurate with respect to the current status of these lands. It does, however, state that the sensitive species supported by the salt works should be protected. It further states that should the site no longer be used for solar salt production, then the new use should be compatible with the resource goals and objectives of the MHPA and other regulations/policies applicable to the site or that the site should be enhanced or restored.

The City of San Diego's MSCP Subarea Plan also includes management policies and directives for the Otay River Valley. The Plan's primary goal for this area is to maintain a fairly unrestricted floodplain containing natural riparian and wetland habitats. Specific directives for the Otay River mouth include restoring the salt ponds to baylands by breaching levees in several locations, if solar salt operations cease, and converting the disturbed agricultural lands west of I-5 either to sustainable agriculture or restoring them to native habitat to provide foraging areas for wildlife.

#### **3.6.1.4 Aircraft Operations in the South Bay**

The military maintains several helicopter and fixed wing air routes over San Diego Bay, which are used primarily, but not exclusively by military flights in and out of Naval Air Station, North Island (NASNI) and Naval Outlying Landing Field (NOLF), Imperial Beach. The current instrument approach (TACAN) used by fixed wing and rotary wing aircraft to Runway 29, NASNI, is from south to north, up the middle of the bay at an altitude of between 1,600 and 2,300 feet. Military aircraft also operate over the bay using visual flight rules (VFR) approach and departure corridors, which extend the entire length of the bay. Within this "bay approach" corridor, military aircraft operate at altitudes of between 500 and 800 feet. Departures from Runway 36, NASNI, travel from north to south, down the middle of the bay at an altitude of about 500 feet. These flights leave the airspace above the bay either to the southeast at about the location of the South Bay Power Plant or to southwest over the Naval Radio Receiving Facility (NRRF). A VFR helicopter route also extends northwest to southeast over Sweetwater Marsh Unit, entering the airspace above the bay just south of the National City Marine Terminal (*Rollins 1998*).



### **3.6.1.5 Military Operations in and Around San Diego Bay**

Considered the center of the largest Naval Complex in the nation, San Diego, and in particular, San Diego Bay, supports important naval operations (U.S. Navy 2002). The three major naval bases in the vicinity of San Diego Bay include Naval Base San Diego, Naval Base Point Loma, and Naval Base Coronado (NBC) (Figure 3-23). There are four U.S. Navy land units within the NBC that are located on or near San Diego Bay; these include Naval Air Station North Island, Naval Amphibious Base Coronado (NAB Coronado) with its Silver Strand training beaches, Naval Radio Receiving Facility (NRRF), and Naval Outlying Landing Field Imperial Beach. The mission of the Navy at NBC is to equip, maintain, train, and support Naval surface and aviation units of the Pacific Fleet and other operating forces in order to conduct military operations in support of the Fleet's operational commanders (U. S. Navy 2002). The operations closest to the Refuge occur at NAB Coronado's bayside beach training areas and at NRRF. Basic, special, and expeditionary warfare training and operations are supported at NAB Coronado and NRRF is used primarily by the Naval Special Warfare community for clandestine training (U. S. Navy 2002). In August 2001, the Navy published a Notice of Intent to prepare an EIS for optimizing current and future operations, training, and maintenance at the beaches of NAB Coronado and the NRRF. The EIS is not yet available for public review; however, according to the NOI, the EIS will address the potential effects of integrating use of NAB and NRRF for current operations and for adding new types of operations at NAB and NRRF.

To ensure compliance with natural resource protection laws, the Navy has prepared Integrated Natural Resources Management Plans (INRMPs) for their operations in San Diego Bay and at NBC. The San Diego Bay Integrated Natural Resources Management Plan (U.S. Navy 2000) is a long-term strategy sponsored by the Navy and the Port to provide direction for the good stewardship of natural resources, while also supporting the ability of the Navy and Port to meet their missions and continue to function within the Bay. The plan serves as a planning tool, management guide, reference document, and policy strategy for the Navy and the Port. The Integrated Natural Resources Management Plan for Naval Base Coronado (U.S. Navy 2002) was prepared to provide Naval Base Coronado with a viable framework for managing natural resources on lands it owns or controls. These INRMPs are prepared to address operations for a period of five years.

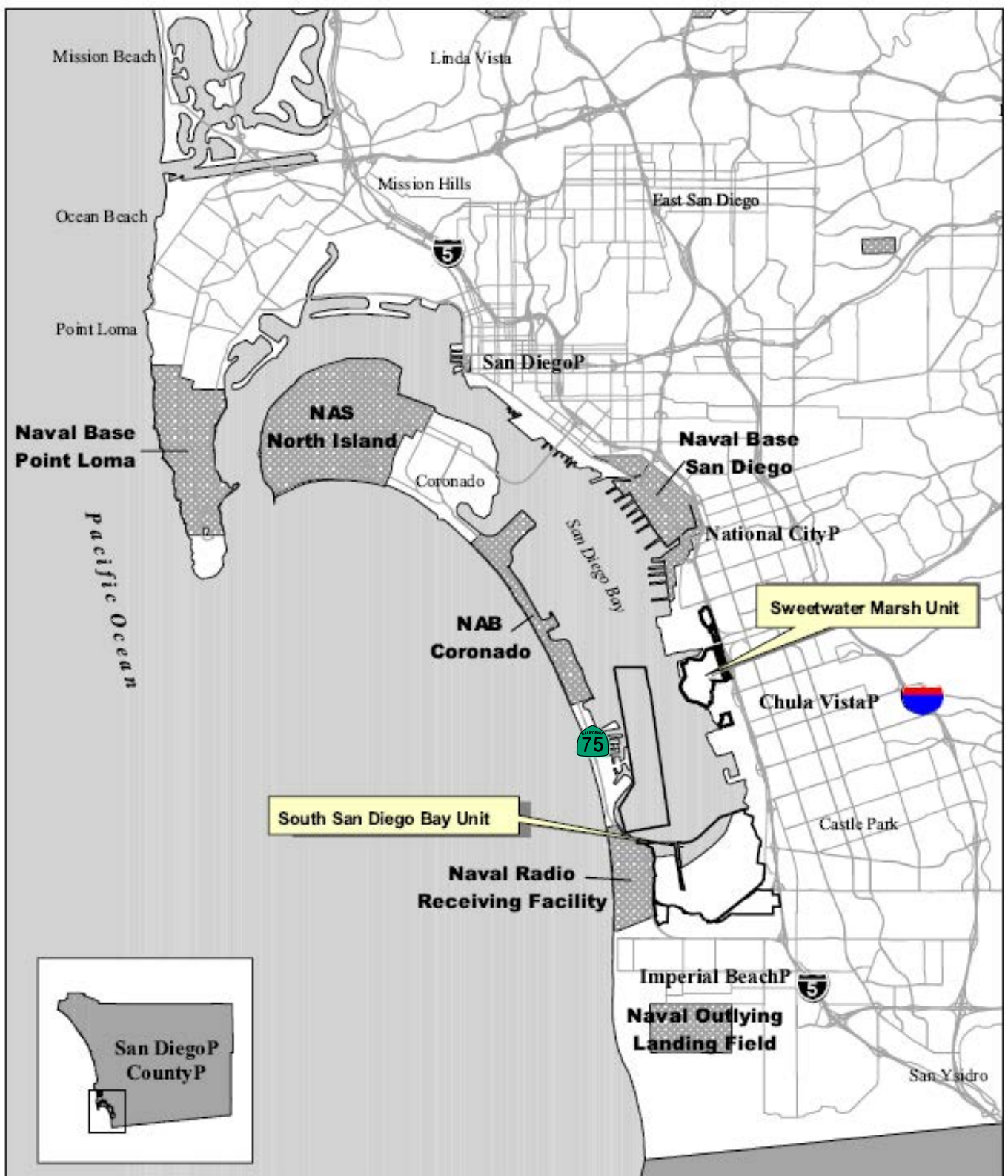
### **3.6.2 Traffic Circulation/Parking**

The Refuge can be accessed via local streets and regional transportation corridors. In addition, activities associated with the Refuge, such as wildlife observation and general refuge operations, would involve the need for some off- and/or on-street parking. Information regarding current and future traffic volumes and parking availability is provided to facilitate the evaluation of how changes in current uses and activities on the Refuge could affect traffic circulation and parking in the vicinity of the Refuge.


#### **3.6.2.1 Traffic Circulation**

##### **Sweetwater Marsh Unit**

The current vehicle trips generated as a result of refuge-related management and public use activities, as well as the Chula Vista Nature Center, are estimated at approximately 100 trips per day. This is based on an estimated 35,000 visitors per year to the Nature Center, of which approximately 5,000 are students who arrive via a school bus, and an estimate of the number of employee, volunteer, and service related trips that are generated by both the Nature Center and the Refuge. All of these trips are accommodated by a series of local streets within the cities of National City and Chula Vista, as well as I-5, which provides regional access. Table 3-19 provides the current street classifications,



**Figure 3-23P**  
**Navy Lands in Proximity to the San Diego Bay NWRP**

 Navy lands



Source: California Spatial Information Library, SANDAG, Tele Atlas, USFWSd

Carlsbad Field Office - 2003d  
 /stem/stacey/sadb/fig\_4-03/fig3-21.apr

design capacity at Level of Service (LOS) C, and current average daily traffic volumes (ADT) for those roadway segments that provide access to the Sweetwater Marsh Unit.

The term Level of Service is used to describe the operational conditions of a particular roadway segment or intersection. LOS is a qualitative measure that generally describes these conditions in terms of speed, travel time, freedom to maneuver, comfort and convenience, and safety (*Whitson 2000*). LOS A is typically described as free flowing; LOS B, free to stable flow with light to moderate volumes; LOS C, moderate volumes, freedom to maneuver noticeably restricted; LOS D, approaches unstable flow with heavy volumes and limited freedom to maneuver; LOS E, extremely unstable flow with maneuverability and psychological comfort extremely poor; and LOS F, heavy congestion with stop and go traffic and delays of greater than one minute per vehicle at signalized intersections.

**Table 3-19**  
**Existing Traffic Volumes and Street Capacities**  
**in the Vicinity of the Sweetwater Marsh Unit**

Street Segment	Classification	Capacity (thousands)	ADT <sup>1</sup> (thousands)
<i>City of National City</i> <sup>2</sup>			
24th Street (I-5 to Harrison Ave.)	2 Lane Collector w/ Dedicated Turn Lanes	20.0	10.0
Harrison Ave. (24th St. to 32nd St.)	2 Lane Collector	7.5	4.8
<i>City of Chula Vista</i> <sup>3</sup>			
E Street (Bay Blvd. to I-5)	4 Lane Major	30.0	14.5
E Street (I-5 to Woodlawn Ave.)	4 Lane Major	30.0	32.2
E Street (Woodlawn Ave. to Broadway)	4 Lane Major	30.0	23.6
Bay Blvd. (E St. to F St.)	2 Lane Class II Collector	12.0	6.5
Bay Blvd. (F St. to G St.)	2 Lane Class II Collector	12.0	2.8

<sup>1</sup>SANDAG (1996 – 2000) Average Daily Trip Volumes

<sup>2</sup>Source for Classifications and Capacity, City of National City (1998a)

<sup>3</sup>Chula Vista data provided by Michael Maston (pers. comm.) and David Kaplan (pers. comm.)

In San Diego, the region-wide goal for an acceptable LOS on all freeways, roadway segments, and intersections is “D;” however, local jurisdictions, as well as Caltrans, have slightly different LOS objectives. For example, the City of Chula Vista currently has an established threshold standard of LOS C at all intersections, except for two hours per day when LOS D is permitted (*City of Chula Vista 1993*).

Based on the design capacities and current traffic volumes for the various roadway segments in the vicinity of the Refuge, the portion of E Street just to the east of I-5 is currently operating at LOS D, while the remaining segments are operating at LOS C or better. According to the San Diego Association of Governments (SANDAG) 20/30 Regional Transportation Plan (2002), I-5 is currently operating at LOS F north of Highway 54 and LOS D south of Highway 54 during peak traffic hours. Available traffic volumes on various segments of this freeway include 196.9 ADT between 24<sup>th</sup> Street and Highway 54, 146.3 ADT between Highway 54 and E Street, and 171.6 ADT between E Street and H Street (*SANDAG 1996 – 2000*).

### **South San Diego Bay Unit**

It is estimated that less than 100 vehicle trips per day are currently generated from activities related to this Refuge. These activities include Service employee visits for monitoring and maintenance, occasional tours of the salt works, occasional trucks delivering maintenance materials, and the activities associated with the current solar salt operation. The limited traffic generated by current Refuge management activities on the South San Diego Bay Unit is accommodated by a number of local streets within the cities of Chula Vista, San Diego, and Imperial Beach, as well as by I-5 and SR-75. Table 3-20 provides the street classification, design capacity, and current ADT for those roadway segments that provide access to the Refuge. The design capacity for the streets in the City of San Diego represent the capacity at LOS D, while the design capacity for the streets in the Cities of Chula Vista and Imperial Beach, as well as SR-75, represent the capacity at LOS C.

<b>Table 3-20</b> <b>Existing Traffic Volumes and Street Capacities</b> <b>in the Vicinity of the South San Diego Bay Unit</b>			
<b>Street Segment</b>	<b>Classification</b>	<b>Capacity (thousands)</b>	<b>ADT<sup>1</sup> (thousands)</b>
<b>City of Chula Vista<sup>2</sup></b>			
Bay Blvd./Frontage Rd. (Palomar to Anita)	2 Lane Class II Collector	12.0	2.2
Bay Blvd. (L St. to Palomar)	2 Lane Class II Collector	12.0	6.8
<b>City of San Diego<sup>3</sup></b>			
Main St. (west of I-5)	2 Lane Collector	5	Not Available
Palm Ave. (I-5 to Saturn Blvd.)	6 Lane Prime Arterial	55	70.1
Palm Ave. (Saturn Blvd. to 13 <sup>th</sup> St.)	6 Lane Major	45	51.3
Saturn Blvd. (Boundary to Palm Ave.)	4 Lane Major	35	22.1
Saturn Blvd. (Palm Ave. to Elm St.)	4 Lane Major	35	13.9
<b>Imperial Beach</b>			
Palm Ave. (13 <sup>th</sup> to 9 <sup>th</sup> )	6-Lane Prime Arterial	Not Available	37.2
Palm Ave. (9 <sup>th</sup> to Delaware)	6-Lane Prime Arterial	Not Available	24.6
SR 75 (Delaware to 7 <sup>th</sup> )	6-Lane Prime Arterial	Not Available	22.2
SR 75 (7 <sup>th</sup> to Rainbow)	4-Lane Major	Not Available	18.5
13 <sup>th</sup> Street (North of Palm Ave.)	3-Lane Collector	Not Available	5.2 <sup>4</sup>
9 <sup>th</sup> Street (Cypress to Palm Ave.)	2 and 3-Lane Collector	Not Available	5.0
7 <sup>th</sup> Street (North of Palm Ave.)	2-Lane Collector	Not Available	Not Available
Cypress Avenue	2-Lane Residential	Not Available	Not Available
<b>Coronado<sup>4</sup></b>			
SR 75 (Rainbow to Coronado Cays)	6-Lane Prime Arterial	28	20.7

<sup>1</sup>SANDAG (1996 – 2000) Average Daily Trip Volumes

<sup>2</sup>Source for Classification and Design Capacity, Michael Maston (pers. comm.)

<sup>3</sup>Source for Classification (City of San Diego 1997), for Design Capacity, Labib Qasem (pers. comm.)

<sup>4</sup>Source City of Imperial Beach, Public Works, Street Division, Traffic Count (11/02)

<sup>5</sup>SR 75 is maintained and managed by Caltrans, District 11

As stated previously, a San Diego region-wide goal of LOS D has been established for all freeways, roadway segments, and intersections. While the City of San Diego finds LOS D

to be acceptable, the currently adopted Circulation Elements for the cities of Chula Vista and Imperial Beach establish a higher standard. Imperial Beach's Circulation Element establishes a threshold standard of LOS C or better for arterial and local streets under average daily traffic volume conditions, while it is acceptable for signalized intersections under peak hour conditions to operate at LOS D or better. A lower standard is also acceptable for special events and seasonal beach related traffic (*Imperial Beach 1994*).

Access in and around the Refuge via local streets includes Palomar and Bay Boulevard in Chula Vista; Main Street, Palm Avenue, and Saturn Boulevard in San Diego; Palm Avenue, from 13<sup>th</sup> Street to Rainbow Drive, 13<sup>th</sup> Street, Florida Street, 9<sup>th</sup> Street, Delaware Street, 7<sup>th</sup> Street, and Cypress Avenue in Imperial Beach; and SR-75 in Coronado. Of these streets, Palm Avenue between I-5 and 13<sup>th</sup> Street in the City of San Diego, experiences average daily traffic volumes in excess of the street's carrying capacity at LOS D. All of the other streets, including the portion of Palm Avenue located within the City of Imperial Beach, are currently operating at LOS C or above.

It should be noted that the streets in Imperial Beach were constructed prior to the City of Imperial Beach's incorporation and as a result, the City of Imperial Beach has never developed its own design capacity figures for these streets. In order to evaluate the current level of service on the road segments surrounding the Refuge, the street classifications assigned to the streets in Imperial Beach by the Circulation Element of the General Plan (*Imperial Beach 1994*) were compared to similar street classifications in the adjoining jurisdictions. The design capacities at LOS C, as determined by Chula Vista and San Diego for similar street classifications, were then compared to the current traffic volumes on the road segments in Imperial Beach. Based on these comparisons, it appears that these roadway segments are currently operating at LOS C or above.

According to SANDAG's 20/30 Regional Transportation Plan (2002), I-5 operates at LOS D south of Highway 54 during peak traffic hours. Available traffic volumes on various segments of this freeway include 156.9 ADT between L Street and Palomar, 158 ADT between Palomar and Main Street and 154.5 ADT between Main Street and Palm Avenue (*SANDAG 1996 – 2000*).

### **3.6.2.2 Parking**

#### **Sweetwater Marsh Unit**

Refuge visitors who wish to park in order to participate in wildlife dependent recreational uses in the vicinity of Sweetwater Marsh and Gunpowder Point currently use a parking lot located at the terminus of E Street, near the E Street/I-5 interchange. This parking lot, which is maintained by the City of Chula Vista for the Chula Vista Nature Center, consists of 50 marked parking spaces; however, if needed, the parking lot can be configured to accommodate 75 to 80 vehicles. The public is transported from the parking lot to the Nature Center via a transit bus. The property on which this parking lot is located is part of the Midbayfront development site. If this area is ultimately developed for urban uses, the parking lot would most likely be relocated to an area closer to the Refuge boundary. It is anticipated that a similar number of parking spaces would be provided within the new lot.

Parking is provided for Refuge employees and Service vehicles in a small, unpaved lot located across the primary access road to the east of the Refuge Office. Approximately 10 vehicles can be accommodated in this lot. Parking for an additional two to three vehicles is available immediately to the east of the Refuge office and another two or three vehicles can

be accommodated about 50 yards to the south of the Refuge office. Nine parking spaces located adjacent to the Nature Center are designated for Nature Center employees. Access for bus loading and unloading is also provided in front of the Nature Center to accommodate Nature Center visitors, as well as students participating in the various educational programs conducted by the Nature Center. No Refuge parking is provided in the vicinity of Paradise Marsh or the F&G Street Marsh; however, public parking is available nearby either on the street or in public parking lots.

### **South San Diego Bay Unit**

Public parking in the vicinity of the South San Diego Bay Unit is currently available along limited portions of Bay Boulevard in Chula Vista, in a small parking lot at the northern terminus of 13<sup>th</sup> Street in Imperial Beach, and along several public streets in Imperial Beach. The parking lot on 13<sup>th</sup> Street includes 13 parking spaces and was created to accommodate users on the Bayshore Bikeway. On-street parking is permitted near the southern end of the bay in the City of Imperial Beach along 13<sup>th</sup> Street, on Cypress Avenue, on the south side of Boulevard between 12<sup>th</sup> Street and Florida Street, and on Cherry Avenue between 10<sup>th</sup> Street and 11<sup>th</sup> Street. Much of this on-street parking serves the surrounding single and multi-family residents in the area. The parking spaces along Cherry Avenue provide overflow parking for the adjacent Bayside Elementary School and the City of Imperial Beach Public Works Yard, although there are no signs posted in this area to control who uses the spaces. Public parking is also available at the South Bay Biological Area, which was recently renovated as part of the Silver Strand Improvement Project. This parking lot, which accommodates 22 vehicles, is available for public parking throughout the day except between the hours of 2 AM and 6 AM, when all parking is prohibited.

## **3.6.3 Public Utilities/Easements**

### **3.6.3.1 Sweetwater Marsh Unit**

The only public utilities present within the Sweetwater Marsh Unit are a 12 kilovolt (kV) electrical distribution line that extends onto the Refuge within an underground conduit and a potable water distribution line. Both of these utility lines provide services to the Nature Center and Refuge office. No gas or sewer lines are present on the Refuge. Sewage generated at the Nature Center and Refuge office is stored in holding tanks until the sewage is pumped into a transport truck and taken to an appropriate off-site treatment facility. Immediately to the east of the Refuge within a 150-foot-wide right-of-way is a major north/south electrical transmission corridor and an abandoned ten-inch fuel pipeline that once served the South Bay Power Plant.

### **3.6.3.2 South San Diego Bay Unit**

The open waters of the South San Diego Bay Unit are not encumbered by public utilities. Of the upland areas included within the Refuge, the most significant number of public utilities occur within the Otay River floodplain. Some of these utilities occur within existing easements on Refuge property, while others are located within a dedicated, unimproved street, owned by the City of San Diego and located outside the current Refuge boundary (refer to Figure 3-19). There are six such dedicated, unimproved streets (“paper streets”) within the Refuge’s approved acquisition boundary. These include: 1) 60-foot-wide Saturn Boulevard (also referred to as 19<sup>th</sup> Street on some documents), which extends north/south through the Refuge; 2) a 40-foot-wide unnamed street, located to the west of Saturn Boulevard that extends north into the Refuge for a distance of approximately 670 feet from the southern Refuge boundary; 3) a 600-foot section of 25-foot-wide Louret Avenue, which extends east from Saturn Boulevard through the southern portion of the Refuge; 4) 60-foot-wide Charles Avenue, located north of Louret Avenue, extends east/west

for approximately 1,160 feet from the eastern boundary of the Refuge to Saturn Boulevard; 5) 30-foot-wide Marian Avenue is north of Charles Avenue and extends approximately 1,110 feet from the eastern Refuge boundary to Saturn Boulevard; and 6) 50-foot-wide Anita Avenue, which extends north/south through the Refuge between Louret Avenue and Marian Avenue for a distance of 560 feet. If these roads were to be vacated, ownership would revert to the adjacent property owner, which in this case is the Federal government.

Various public utilities are located within these unimproved, dedicated streets, including sewer and water lines, electric lines, and several high pressure gas lines. Included within 60-foot-wide Saturn Boulevard right-of-way are a 54-inch sewer interceptor line (the South Metro Interceptor), a 36-inch gravity sewer line, a 24-inch storm drain, an 8-inch and a 3-inch gas line, and an 8-inch water line. In addition, a combined 69 kv/128 kV electrical transmission line is included within this 60-foot-wide corridor. A 27-inch sewer line, owned and maintained by the Montgomery Sanitation District, extends from I-5 west in Louret Avenue then turns north on Anita Avenue, continuing north within an easement through Refuge property and on toward Main Street. The 36-inch gravity sewer line that extends north/south in Saturn Boulevard turns east at Louret Avenue then north in Anita Avenue. At Marian Avenue, the line enters a diversion structure then travels north as a 30-inch sewer line, paralleling the 27-inch line described above. A 4-inch gas line is also present in Louret Avenue from Saturn Boulevard to I-5. An 18-inch abandoned sewer line extends north through Refuge property from the Otay River pump station to the site of the old Palm City sewer pump station. Another 21-inch abandoned sewer line extends east from the old Palm City pump station through Refuge property to Saturn Boulevard.

Some of the utilities within the Saturn Boulevard right-of-way extend onto Refuge property via a recorded easement at a point just north of the Marian Street right-of-way. These include the 8-inch gas line, 69/138 kV electrical transmission lines, the 54-inch South Metro Interceptor sewer line and a 57-inch force sewer main, all of which extend northeast from Marian Street to Main Street. A trail easement that generally follows the alignment of the South Metro Interceptor also extends from the Saturn Boulevard right-of-way, through Refuge property toward Main Street.

Within the salt works, there are several overhead electrical distribution lines that provide power to the water pumps used in the solar salt operation. In addition, there is a 12 kV overhead electrical distribution line that extends along the western edge of Pond 10A, paralleling SR-75. This line continues north to Coronado. The City of Coronado proposes to underground the portion of this line that extends from Coronado's southern city limits to the Coronado Cays (*City of Coronado 2001*). This project would occur outside of the Refuge boundary along SR-75.

The City of Imperial Beach maintains five storm drain outlets that affect the waters within the Refuge. These include a 36-inch reinforced concrete pipe that empties into the Otay River channel between 12<sup>th</sup> Street and Florence Street, a 10-inch pipe that empties into the Otay River between 11<sup>th</sup> Street and Florida Street, a 48-inch reinforced concrete pipe that empties into the Otay River just north of the Bay Shore Elementary School, and a 24-inch reinforced concrete pipe that empties into Pond 10A after crossing under SR-75 from 5<sup>th</sup> Street. There is also a small discharge pipe that empties into Pond 10A from 7<sup>th</sup> Street, between Boulevard Avenue and Basswood Avenue.

#### **3.6.4 Recreation**

According to the San Diego Convention and Visitors Bureau, it is estimated the San Diego region registered 26.4 million visitors in 2002. Unfortunately, no specific data is available regarding the number of tourists and residents who visit the attractions and open space areas around San Diego



Bay each year. San Diego Bay represents one of many established tourist destinations in the San Diego region. In addition to over 250 acres of open space, the bay also provides 27 miles of waterfront, 10 miles of pathways that front the bay, 22 marinas, three museums and a nature center, numerous restaurants and hotels, and a variety of unique shopping experiences. In the southern end of the bay there are opportunities to participate in a variety of recreational activities, including boating, fishing, wildlife observation, biking, hiking, and some forms of organized sports. Prior to the urbanization of this area, duck and waterbird hunting also occurred here. Each of these activities is described in greater detail in the text that follows.

### **3.6.4.1 Boating**

#### **Sweetwater Marsh Unit**

Within the Sweetwater Marsh Unit, open water is limited to the channels that meander through the marsh habitat. These waters are currently closed to boating.

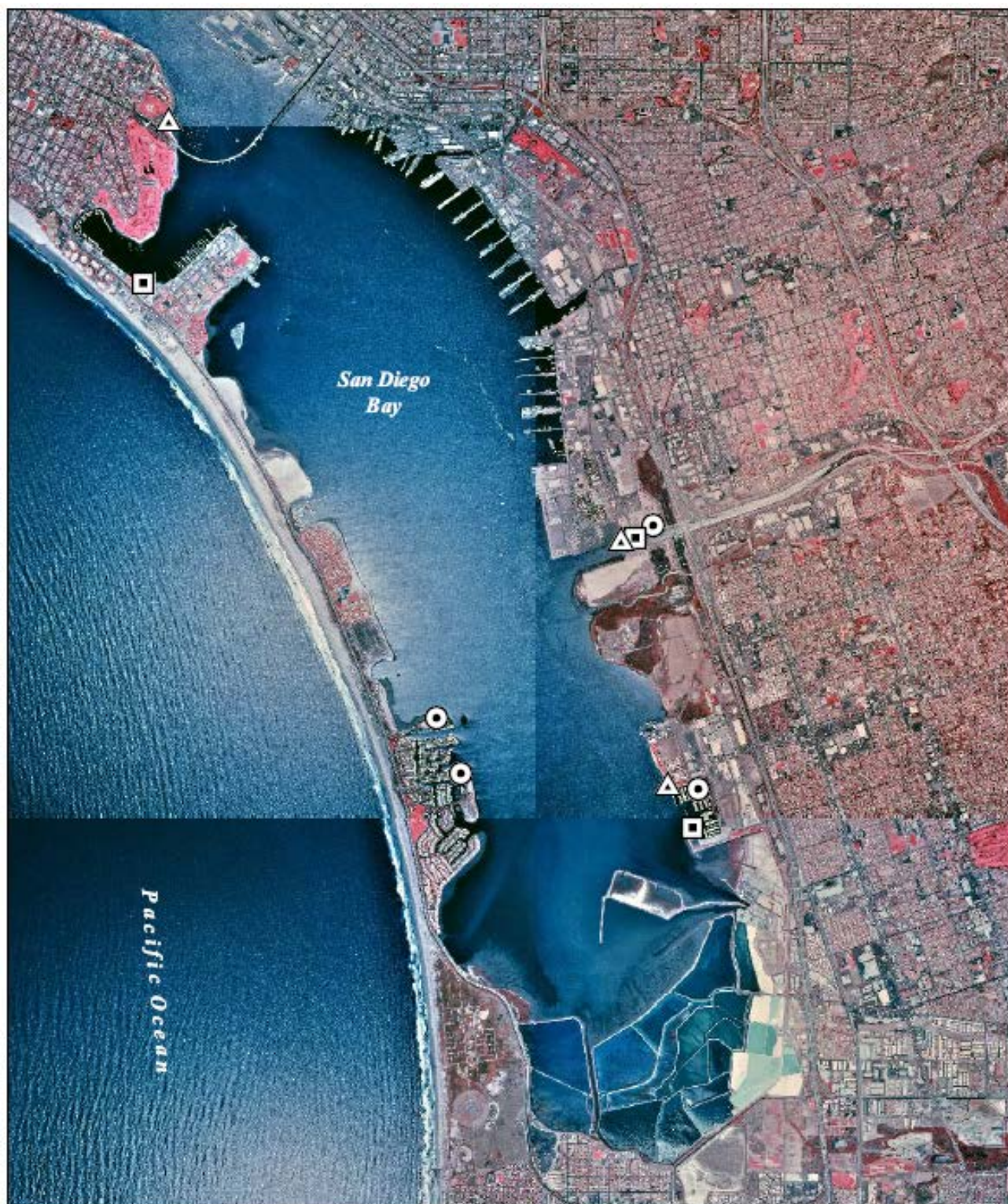
#### **South San Diego Bay Unit**

San Diego Bay, which accommodates a wide range of year-round boating activities, supports U.S. Navy ships and small boat activity, commercial ship traffic, and various forms of recreational boating. Studies conducted to characterize the boat traffic patterns in the bay demonstrate that most of the Bay's boating activity takes place to the north of the Sweetwater Flood Control Channel (*U.S. Navy 2000*). This is due in large part to the shallow water depths in the South Bay. Artificial deep water channels have been constructed along the east and west sides of the bay to facilitate the passage of larger boats into and out of the Chula Vista Marina and the Coronado Cays. These channels are located outside of the approved acquisition boundary for the South San Diego Bay Unit.

Most boat activity that occurs within Refuge waters is associated with sightseeing, wildlife viewing, exercising, fishing, and general recreating. The shallow water depths, which range from 1 foot to 6 feet at low tide, limit the type of boats used in this area to motorized and non-motorized shallow draft vessels, such as rowboats, powerboats, canoes, kayaks, sail boards and personal water craft. Windsurfing and parasailing also occur within this area. No boat inventories for this area are available to depict actual usage by season or day of the week. FWS biologists did however noted boat usage in the South Bay during the 1993 to 1994 weekly bird inventory (*USFWS 1995*) and during the human disturbance study conducted by Huffman (1999). The data provided during these studies indicated that the majority of the boats observed within the South Bay were motorized boats, followed by sailboats, personal watercraft, and sailboards.

Although no boat ramps are provided within the Refuge, there are several public and private boat ramps and marinas just beyond the Refuge boundaries (Figure 3-24). Public boat ramps are available in Chula Vista at Bayfront Park, near the Chula Vista Marina, and in National City at Pepper Park. Marinas located in proximity to the Refuge include the Chula Vista Marina with 552 slips, the Loew's Crown Isle Marina with 80 slips, and two marinas in the Coronado Cays that together provide 756 slips. Another marina is under construction in National City to the east of Pepper Park. Boat rentals including paddle boats, sailboats, and personal water craft are available at the Loew's Crown Isle Marina and water skiing occurs in the bay just off the marina.

Boating speeds in the South Bay are regulated by the Port. Section 4.30(c)3 of the Port Code states "It shall be unlawful for any vessel to be operated at a speed in excess of Five (5) Miles Per Hour in South San Diego Bay as defined in Sec. 4.30(b)1 of this Code, except



**Figure 3-24**  
**Fishing and Boating Facilities in the South Bay**

Boat launch
  Fishing pier
  Marina



Source: USFWS, USGS (1 m imagery, year 2002)3

Carlsbad Field Office - 2003  
 /item/stacey/ssdbay/fig\_4-03/figures.apr3



while transiting the Chula Vista Harbor Channel seaward of daymarks 11 and 12. Vessels must maintain a reasonable and prudent speed pursuant to Section 4.04 of this Code.”

The waters in San Diego Bay are considered United States Navigable Waters; therefore, any future proposals that would limit the public’s right to free access of these waters would require Federal and/or State rulemaking prior to implementation.

### **3.6.4.2 Fishing**

#### **Sweetwater Marsh Unit**

Fishing is not permitted within the Sweetwater Marsh Unit, although significant fishing opportunities are available immediately adjacent to the Refuge in San Diego, as described in detail below.

#### **South San Diego Bay Unit**

According to the Port, San Diego Bay supports approximately 35,000 to 40,000 recreational angler days per year. Much of this fishing is from boats and using the catch-and-release method (*U.S. Navy 2000*), although fishing is also popular from the various fishing piers around the bay. The closest fishing piers to the Refuge are located at Pepper Park in National City and Bayside Park in Chula Vista (refer to Figure 3-24). Refuge staff has also documented unauthorized fishing in Pond 11. According to a survey conducted by the County in 1990 (*San Diego County Department of Health Services 1990*), 74 percent of the fish caught in the bay was represented by four species: Pacific mackerel, California lizardfish, barred sand bass, and spotted sand bass. In addition, some anglers fish for finfish and shellfish species not eaten by other anglers (*U.S. Navy 2000*). A study conducted by the Environmental Health Coalition (2005) to look at fish consumption patterns in San Diego Bay found that 58 percent of the fishers contacted during the survey fished in the bay at least once a week and 25% fished in the bay daily. A high percentage of those participating in subsistence fishing in the bay are believed to consume the entire fish, rather than eating only the muscle.

One commercial fishing boat that targeted striped mullet operated in the bay from 1979 to 1995; however, no commercial fishing operations are active in the bay today (*M. Fluharty pers. comm.*), with the possible exception of the collection of bait fish. Possible reasons for the lack of commercial fishing include health concerns related to water pollution in the bay, reduced fish populations, and economic pressures.

The evaluation of the potential health risk to humans from fish caught and consumed in San Diego Bay that was conducted by the County in 1990 (*San Diego County Department of Health Services 1990*) identified potential health risks to unborn or young children through the consumption of mercury-contaminated fish by pregnant and/or breast-feeding women and also from direct consumption of contaminated fish by young children (up to ten years of age). Adult consumers who eat more than 165 grams per day of such fish, especially barred and spotted sand bass, could also be at risk. The levels of PCBs found in fish analyzed in San Diego Bay were also considered a potential risk to human health at consumption levels at or above 165 grams per day. Based on these results, the San Diego County Health Officer posted health advisories at seven locations around the bay including the major public fishing piers to inform the public about the potential health risks associated with the consumption of fish from San Diego Bay. Although many of these signs are no longer in place, the risks remain the same. The County is currently working with the Port and others to install new signs at appropriate locations. The Environmental

Health Coalition and others are also continuing to evaluate the potential risks of current fish contamination levels in the bay to those individuals who consume fish at above average consumption levels, eat the whole fish rather than just the muscle, and/or eat the fish raw rather than cooked.

The State of California has not published any specific fish consumption advisories for San Diego Bay, primarily because the specific studies necessary to establish these advisories have not been conducted for the Bay and because the State's Office of Environmental Health Hazard Assessment (OEHHA) already provides general advice on how to reduce your exposure to chemicals in sport fish. This advice addresses fishing practices, such as consuming fish caught at a variety of locations, as well as consumption guidelines that suggest consuming smaller amounts of a variety of fish species, eating smaller fish of a particular species, eating only fillet portions, and avoiding the consumption of raw sport fish (State of California 2002).

Some shellfish, particularly mussels, may contain natural toxins that cause paralytic shellfish poisoning (PSP) or other serious illness, and even death. Because these toxins are not destroyed during cooking, shellfish quarantines may be issued by OEHHA. Throughout California, mussels are quarantined from May 1 through October 30, and local quarantines may be posted for other bivalves if monitoring indicates a potential health risk. The State maintains a 24-hour PSP information line in an attempt to keep the public informed of such quarantines (*State of California 2002*).

### **3.6.4.3 Wildlife Observation and Photography**

#### **Sweetwater Marsh Unit**

Opportunities for wildlife observation and photography on the Sweetwater Marsh Unit are currently provided from Gunpowder Point. Existing observation points include an elevated observation platform at the Chula Vista Nature Center, which provides impressive views of the surrounding salt marsh habitat that extends to the east and north of Gunpowder Point, and a bird blind located at the edge of the bay that provides observation opportunities of the various shorebirds and waterbirds supported by the mudflats bordering the southern edge of Gunpowder Point. Additional opportunities for observing and photographing wildlife are also provided along portions of the existing trail system on Gunpowder Point. Although opportunities for wildlife observation on the Refuge are limited Gunpowder Point, wildlife activity within Paradise Marsh and the F&G Street Marsh can be observed from the public right-of-way that abuts these areas.

#### **South San Diego Bay Unit**

Within the South San Diego Bay Unit, opportunities for observing and photographing wildlife are available via boats traveling on the bay, from areas adjacent to the Refuge, such as the Bayshore Bikeway and the County's Biological Study Area, and during occasional guided nature tours of the salt works. Bird and sea turtle watching from kayaks and canoes is particularly popular in the South Bay. The Bayshore Bikeway extends for about ten miles from 13<sup>th</sup> Street in Imperial Beach to Coronado and provides a variety of observation points where Refuge wildlife can be observed. With financial assistance from a Transportation Enhancement Act for the 21<sup>st</sup> Century (TEA-21) grant, the City of Coronado and the County of San Diego recently installed an observation deck within the South Bay Biological Study Area (*City of Coronado, 2001*). The deck is located just to the north of Pond 11 and provides the public with the opportunity to observe the wildlife within the Refuge's salt pond system and adjacent mudflats.

#### **3.6.4.4 Environmental Education and Interpretation**

##### **Sweetwater Marsh Unit**

A number of environmental education programs are currently conducted on the Sweetwater Marsh Unit. These programs are conducted in partnerships with the Chula Vista Nature Center, National City, several school districts, and various nonprofit organizations. One program, implemented by the Chula Vista Elementary School District, focuses on a science and social studies curriculum. The program serves some 12,000 kindergarten through 12th grade students annually. The Refuge, specifically Gunpowder Point, provides the outdoor classroom for this program where students study topics such as the tides, water quality, native vegetation, and birds.

Another program, created by the San Diego Zoological Society, Chula Vista Nature Center, and the San Diego NWR Complex through a grant to the Zoo's Habitat Conservation Education Department, is Sweetwater Safari. This program, which meets the State of California's science standards for fourth grade, was created for students to learn about science and the local environment through a hands-on experience. The program includes on-site or on-refuge curriculum and a post-visit curriculum that is conducted in the classroom. The on-site curriculum is taught by the teachers. To lead the self-guided on-site program, which takes place on Gunpowder Point, the teacher must first participate in a training session conducted by Refuge staff, Chula Vista Nature Center staff, and other volunteer teachers. These training sessions, which are provided free of charge, are conducted quarterly at the Chula Vista Nature Center. Once a teacher has completed this training, he or she can arrange a time with the Nature Center to guide his/her class through the program. Equipped with backpacks containing relevant educational materials, the class travels along the 0.5 mile trail system on Gunpowder Point gathering information regarding the many resources supported by the Refuge. The Refuge trails are flat, wide and wheelchair accessible. Transportation grants to bring student onto the refuge are available for this program.

Another program supported by the Refuge is conducted by Kimball Elementary School in National City. This program, which generally occurs just upstream of the Refuge, presents a science and mathematics-based curriculum focused on the protection of watersheds, the function of wetland systems, and water quality testing.

The Refuge also partners with the Chula Vista Nature Center, San Diego Zoo, Kimball Elementary, Paradise Creek Educational Park, Aquatic Adventures, and others to facilitate occasional field trips to the Refuge to support the organizations' desire to introduce students to the biological and cultural resources of the region. The majority of these programs incorporate language arts, math, and social sciences into their curriculum in accordance with California State Education Standards.

Environmental education programs are conducted on the Refuge once or twice a week throughout the year, with field trip opportunities open to only one classroom of approximately 32 students per day. Participants are generally transported to the site by bus or van. In some cases, the students use the existing shuttle bus system operated by the City of Chula Vista.

Opportunities for environmental interpretation on the Sweetwater Marsh Unit are currently available through a series of interpretive panels installed along an existing half-

mile trail system located on Gunpowder Point. The Refuge also benefits from the interpretation provided at the Chula Vista Nature Center. The Center includes a variety of indoor and outdoor interpretive elements that present information about the wildlife and habitats that occur in the vicinity of the Refuge. Of particular interest are the exhibits related to the bay's marine life and a walk-in aviary that includes various shorebirds commonly found in the area. Light-footed clapper rails are also available for viewing. The Nature Center also conducts weekly docent-lead nature hikes along the trail system on Gunpowder Point. Approximately 35,000 people visited the Nature Center during 2003.

Other interpretation in the South Bay is provided by the Port, the County of San Diego, and the City of Coronado. Much of this interpretation occurs adjacent to the bay along the Bayshore Bikeway.

#### **South San Diego Bay Unit**

The South San Diego Bay Unit provides the site for the Habitat Heroes environmental education program. This program provides second graders through community college students with the opportunity to participate in an education program that focuses on two significant threats to coastal wetland habitat quality: invasive plant species and storm water pollution. The program incorporates the use of GIS technology, cross-age student mentoring, and habitat-based investigations with traditional and internet-based instruction. The outdoor components of this program are conducted on the upland areas along the southern boundary of the Refuge Unit. The work completed under the Habitat Heroes program is included on a national web site, "Hands on the Land," which is sponsored by several federal agencies including the Service.

No formal environmental interpretation program is currently implemented on this Refuge Unit.

#### **3.6.4.5 Bicycle Facilities**

The primary bicycle facility in the South Bay is the Bayshore Bikeway, a 26-mile bicycle facility being constructed around San Diego Bay. When completed, this bikeway will consist of combination of bicycle paths, lanes and routes providing convenient and scenic bicycle transportation around the bay. In the vicinity of the Sweetwater Marsh Unit, a segment of the Bayshore Bikeway was recently completed that provides off-road bicycle access from National City, near Pepper Park, to E Street in Chula Vista, skirting around the eastern edge of the Refuge. To the south, in the vicinity of the South San Diego Bay Unit, the off-road portion of the Bayshore Bikeway currently extends west from 13<sup>th</sup> Street in Imperial Beach, around the south end of the Bay and up the Silver Strand to Coronado. This segment of the bikeway provides spectacular views of the salt ponds and the southern end of the bay. Construction plans are currently being processed that, if approved, would enable the bike path to be extended eastward from 13<sup>th</sup> Street to Main Street. This segment of the bike path would be constructed between the salt ponds and the Otay River channel within the old Coronado Branch of the San Diego & Arizona Eastern railroad right of way. The proposed route is not included within the approved acquisition boundary for the South San Diego Bay Unit.

Another bike path, maintained by the City of San Diego, traverses north/south through the Otay River floodplain, primarily within the right-of-way of Saturn Boulevard (an unimproved street right-of-way owned in fee title by the City of San Diego). This bike path provides access from Main Street to Palm Avenue.

#### **3.6.4.6 Hiking/Interpretive Trails**

The only official walking trails currently in place on the San Diego Bay NWR are located on the Sweetwater Marsh Unit. The half mile of trails on Gunpowder Point provide access from the Nature Center to the edge of the bay for interpretation, environmental education, and wildlife observation. Trails are only open during Nature Center hours, which are generally 10 AM to 5PM Tuesday through Sunday.

Trail planning is currently underway for the Otay Valley Regional Park (OVRP). The goal is to provide trail access along the entire length of the OVRP, which extends from the bay to the Otay Lakes Reservoirs. The boundaries of the western most segment of the OVRP overlap with the current boundary of the South San Diego Bay Unit. The trail proposal for this area, as described in the Otay Valley Regional Park Trail Guidelines (*County of San Diego 2003*), is to extend a regional trail linkage under I-5 to connect with the existing bike path in Saturn Boulevard, ultimately providing a connection to the Bayshore Bikeway. Additional trails are being considered for inclusion in the Chula Vista Bayfront Redevelopment Plan. The current vision is to provide a connecting system of trails that will provide the public with access to and along the eastern edge of San Diego Bay.

#### **3.6.4.7 Developed Park Land**

A number of active parks have been developed in the vicinity of the Refuge, including Chula Vista Bayfront Park at the foot of Marina Way, Chula Vista Bayside Park at the end of Bayside Parkway, Chula Vista Marina View Park on Marina Park Way at Marina Way, Coronado Grand Caribe Shoreline Park, and Pepper Park in National City. Silver Strand State Beach is located to the northwest of the South San Diego Bay Unit.

#### **3.6.4.8 Hunting**

Hunting is not currently permitted on the San Diego Bay NWR, and there are no other opportunities for hunting in the immediate vicinity. Within the San Diego County region, waterfowl hunting is currently offered seasonally at Barrett Lake and Lake Sutherland, both operated by the City of San Diego. Waterfowl hunting has also historically been available at Lake Cuyamaca. Opportunities for upland game hunting are available within the California Department of Fish and Game's San Felipe Valley Wildlife Area and Boden Canyon Ecological Reserve, as well as within portions of the Cleveland National Forest.

### **3.6.5 Vectors and Odors**

#### **3.6.5.1 Vectors**

##### **Sweetwater Marsh Unit**

A vector is any insect or other arthropod, rodent, or other animal of public health significance capable of causing human discomfort, injury, or capable of harboring or transmitting the causative agents of human disease. The vector of most interest within the Refuge is the mosquito. Twelve mosquito borne viruses are currently known to occur in California; including western equine encephalomyelitis virus, St. Louis encephalitis virus, and West Nile virus

The County of San Diego, Department of Environmental Health, Vector Surveillance and Control Program is responsible for the monitoring and control of vectors, and in particular mosquitoes, in all of San Diego County. The mosquito surveillance traps located closest to the San Diego Bay NWR are maintained near Hollister Street where it crosses the Otay River. Based on trapping results provided by the County of San Diego for these traps during 2003 (*Chris Conlon, pers. comm. December 16, 2003*), the following species of



mosquitoes could occur on the Sweetwater Marsh and/or South San Diego Bay Unit when conditions are appropriate to support them:

- *Culex tarsalis* – This species is the most competent vector mosquito in San Diego County and is quite common in the Otay traps. It is most active in the spring, winter, and fall.
- *Culex erythrothorax* – This species, which is the most common mosquito species in San Diego County, is very common in the Otay traps. It is typically considered a nuisance, but has also been observed to vector disease.
- *Culex pipiens/quinqüefasciatus* – A fairly competent disease vector, this species is only detected in measurable numbers when stagnant water is present in the area.
- *Anopheles hermsi* – This species of mosquito is very common in the Otay traps. Where malaria exists, this species is known as a very competent vector of the disease.
- *Ochlerotatus increpitus* – This species, which breeds in many fresh water situations, can also be commonly found in the Otay traps. An annoying day biter, this species represents more of a nuisance than a disease vector.
- *Ochlerotatus taeniorhynchus* – This species, which is common in salt marsh habitat, is typically present between May and October. It is not considered a significant vector, but can be a day biting nuisance.
- *Ochlerotatus sierrensis* – This species, which breeds in tree holes and bites during the day, is often found in the traps in very small numbers. This mosquito is known to transmit heartworm to dogs.
- *Culiseta inornata* – This species, which breeds in fresh or brackish water, is not common in the Otay traps, but when it is present, it usually occurs in small numbers during the cooler months. This mosquito is also considered a nuisance and is not an important disease vector.
- *Culiseta incidens* – Regularly found in the Otay traps in small to moderate numbers, this species is not considered to be a disease vector, but can be a biting nuisance. It can breed in fresh or brackish water.
- *Culiseta particeps* – Also regularly found in the Otay traps in small to moderate numbers, this species breeds primarily in freshwater and is generally considered a biting nuisance, rather than a disease vector.
- *Ochlerotatus squamiger* – This species generally occurs in intertidal marshes of the California coast, where the female lays eggs in puddles in the extreme high tide zone. When present, it is most common in February and March. This species was not observed in the traps in 2003; however, it has occurred in the South Bay region in the past.

It is not known at this time which, if any, of these species are vectors of the West Nile virus; however, the California Department of Health Service considers *Culex tarsalis* a potential vector of this disease in California.

Within the Refuge, the existing salt marshes and freshwater wetland areas on the Sweetwater Marsh Unit represent potential breeding habitat for one or more of the mosquito species described above. On the South San Diego Bay Unit, potential breeding habitat include the Otay River and Nestor Creek areas and the shallow salt water areas that occasionally form along the edges of the lower reaches of the Otay River.

Although not considered a vector, the hypersaline ponds within the salt works generate substantial populations of brine flies. These flies appear to confine their activities to the boundaries of the Refuge.

#### **South San Diego Bay Unit**

The mosquito species described above could also be present on the South San Diego Bay Unit, which is located downstream of the County's traps near Hollister Street. Potential breeding grounds for mosquitoes on this Refuge include stagnant water areas along the Otay River channel and Nestor Creek and puddles of water resulting from high tides and rainfall in the vicinity of Ponds 10 and 10A.

Although not considered a vector, the salt works does generate substantial populations of brine flies. These flies occur in many of the salt ponds within the Refuge and appear to confine their activities to the boundaries of the salt works.

### **3.6.5.2 Odors**

#### **Sweetwater Marsh Unit**

The generation of unpleasant odors can occur in coastal wetlands as a result of dissolved oxygen depletion and/or algal die-offs. Although odors have been a historic problem in some San Diego County coastal wetland areas, no strong odors have been reported from the Sweetwater Marsh complex.

#### **South San Diego Bay Unit**

The areas within the South San Diego Bay Unit that are most prone to generating strong odors include Ponds 10A, 20, and 22. These odors are produced when a combination of shallow water depths, good light attenuation, warm water temperature, and increased nutrient concentrations result in abundant algal growth and low dissolved oxygen levels.

### **3.6.6 Economics/Employment**

San Diego has a diverse economic base that includes a strong government sector (due in part to the presence of U.S. Navy and Marines installations throughout the area) and active tourism-related industries. The service industry, which includes both personal and business services, employs the largest percentage of people in the region. The population, area, and leading industry of each community are presented in Table 3-21.

A socioeconomic study was conducted in 1994 for the Service to assess the potential impacts, both adverse and beneficial, of implementing habitat protection for the southern portion of San Diego Bay (*Niehaus, Inc. 1994*). This study and its findings are incorporated by reference into this document. An important component of this study was the determination of baseline levels of socioeconomic activity in the study area, including both the current and potential future activity levels. The socioeconomic variables that were analyzed included land uses in the area; economic activity; recreation and tourism activities; local public finance issues; and nonmarket socioeconomic issues. The study characterized existing and projected socioeconomic conditions in the greater San Diego area, as well as in San Diego Bay and South San Diego Bay. It considered the most recent

**Table 3-21**  
**Population, Areas, and Leading Industries by South Bay Community<sup>1</sup>**

Jurisdiction	Population 2000	Change in Population 1990 to 2000	Area (in acres)	Leading Industries <sup>2</sup>
County of San Diego	2,813,833	+315,817	2.7 million	Education, Health, and Social Services, Professional Services
City of Imperial Beach	26,992	+480	2,838	Education, Health, and Social Services, Visitor Services
City of Coronado	24,100	-2,440	9,112	Armed Forces, Education, Health, and Social Services
National City	54,260	+11	5,916	Education, Health, and Social Services, Visitor Services, Manufacturing
City of Chula Vista	173,556	+38,393	33,024	Education, Health, and Social Services, Retail
City of San Diego	1,223,400	+112,851	219,250	Education, Health, and Social Services, Professional Services

<sup>1</sup>Source: U.S. Census, SANDAG, October 2002

<sup>2</sup>Source: U.S. Bureau of the Census, Census 2000

period data available in 1994 and then projected the socioeconomic conditions for these areas through the year 2015.

The commercial solar salt operation that occurs within the South San Diego Bay Unit currently employs between 20 and 25 individuals and generates approximately \$300,000 in local and state sales tax. No revenues from this operation are provided to the Service, but the Airport Authority, which owns the processing plant, does collect a lease payment plus a royalty for every ton of salt purchased from this operation. The current operation produces between 60,000 and 80,000 tons of salt per year; however, the operation will be reduced by 10 to 20 percent following the elimination of the Fenton ponds from the system.

### **3.6.7 Environmental Justice**

The goal of environmental justice in the United States is to afford the same degree of protection from environmental and health hazards to all individuals and communities throughout the nation. Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, State, local, and tribal programs and policies. To achieve meaningful involvement requires that all potentially affected individuals have an appropriate opportunity to participate in decisions about proposed activities that could affect their environment and/or health and that the concerns of all participants are considered in the decision making process.

Historically, low-income and minority communities have suffered disproportionately from exposure to unhealthy environmental conditions, due in large part to the tendency to place facilities and infrastructure that pose a risk to human health in proximity to these communities. In 1994, in response to increased public concern and awareness about such inequities, Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations) was issued. This Executive Order requires each Federal agency to make achieving environmental justice part of its mission by identifying and addressing disproportionately high and adverse human health or environmental effects of its program, policies, and activities on minority and low-income populations. To ensure compliance with this Executive Order, the Service established Environmental Justice Teams responsible for functions, such as ensuring day-to-day implementation of the environmental justice provision of NEPA. The role of these teams is to establish active liaisons with local community groups and Tribal leaders to create an ongoing dialogue about environmental justice and ensure that impacted communities and Tribal leaders are consulted on all new and proposed actions of the Service.

To understand the current proposal's potential effect as it relates to environmental justice, the following information is presented regarding the economic and ethnic composite of the communities that surround the San Diego Bay NWR.

The U.S. Department of Housing and Urban Development (HUD) defines low income as 80 percent of the median family income for the area, subject to adjustment for areas with unusually high or low incomes or housing costs. According to the 2000 Census, the median household income in 1999 dollars was \$44,861 in the City of Chula Vista, \$66,544 in the City of Coronado, \$35,882 in the City of Imperial Beach, \$29,826 in National City, and \$44,124 in the Otay Mesa Nestor Community of the City of San Diego (SANDAG 2002). This compares with an estimated countywide median household income of \$47,067. An income of \$37,650 would represent 80 percent of the median family income for the region; therefore, based on the figures available, several of the communities that surround the Refuges would meet the definition of low income.

The ethnic composite of the areas that surround the San Diego Bay NWR are presented in Table 3-22. For purposes of comparison, the percentage of minorities in the communities surrounding the Refuge is higher than the San Diego Region as a whole.

Table 3-22 Ethnic Composite of the Cities in the Vicinity of the Refuge <sup>1</sup>						
Ethnic Group	Coronado	Chula Vista	Imperial Beach	National City	Otay Mesa Nestor (San Diego) <sup>2</sup>	San Diego Region
American Indian	5%	< 1%	< 1%	< 1%	1%	< 1%
Asian	< 1%	11%	6%	18%	15%	9%
Black	4%	4%	5%	5%	7%	5%
Hawaiian & Pacific Islander	< 1%	< 1%	< 1%	< 1%	1%	< 1%
Hispanic	10%	50%	40%	59%	51%	27%
White	79%	32%	43%	14%	20%	55%
Other	< 1%	< 1%	< 1%	< 1%	< 1%	< 1%
2 or More Races	2%	3%	4%	2%	5%	3%

<sup>1</sup>Source: SANDAG 2002 (except as noted for Otay Mesa Nestor)

<sup>2</sup>Source: U.S. Census Bureau 2002

# ***Chapter 4 – Environmental Consequences***

## **4.1 Introduction**

This chapter provides an analysis and evaluation of the environmental consequences of implementing the alternatives described in Chapter 2. Impact evaluation has been conducted for each aspect of the environments described in Chapter 3 – Affected Environment, including physical, biological, cultural, and socio-economic resources. The adverse and beneficial effects of implementing each alternative are generally described in three main action categories – Habitat and Wildlife Management, Habitat Enhancement/Restoration, and Public Use Program. The cumulative effects on the environment of implementing the various alternatives are presented in Section 4.9.

## **4.2 Effects to the Physical Environment**

Topics addressed under the physical environment section include direct and indirect effects to topography, visual quality, geology, soils, agricultural resources, air quality, noise, hydrology, and water quality. Cumulative effects to the physical environment are addressed in Section 4.9.2.1. The criteria used in this document to determine if a particular impact represents a significant adverse effect are present below for each topic.

- Topography – An adverse topographic effect is considered significant if grading is proposed in a highly scenic area or would alter a locally or regionally important topographic landmark, or proposed grading would substantially alter the existing landform by creating manufactured slopes higher than ten feet or steeper than 2:1 (50 percent).
- Visual Quality – A proposal that would substantially alter the natural landform or block public views to a public resource (such as San Diego Bay) from designated open space areas or public roads would be considered a significant adverse effect on visual quality.
- Geology/Soils – Impacts related to geology and soils would be considered significant if a proposed action would trigger or accelerate substantial slope instability, subsidence, ground failure, or erosion affecting onsite facilities or adjacent facilities, such as roadway and railway embankments and bridge abutments and pilings. Impacts would also be considered significant if a project design were more susceptible to geohazards, such as liquefaction, settlement, ground rupture, or lateral spreading.
- Agricultural Resources – A significant adverse effect on agricultural resources would occur if a Refuge action would result in the conversion of Prime Farmland or Farmland of Statewide Importance to non-agricultural use (refer to Section 3.3.4 for more information regarding these designations).
- Hydrology – An adverse hydrologic effect is considered significant if an action would result in increased flooding on- or off-site, a net deficit in the aquifer volume, or a reduction in the local groundwater table.

- **Water Quality** – Adverse impacts to water quality would be considered significant if the action would violate any water quality standards or waste discharge requirements, substantially increase downstream sedimentation, introduce contaminants (non-point source pollution) into the watershed, or otherwise substantially degrade water quality.
- **Air Quality** - Implementation of a proposed Refuge action would have a significant direct effect on air quality if the action would result in emissions equal to or in excess of the standards outlined in Rule 1501 of the APCD Rules and Regulations (refer to Section 3.3.7); sensitive receptors are exposed to substantial pollutant concentrations, including air toxics such as diesel particulates; or air contaminants are released beyond the boundaries of the Refuge. Significant indirect effects to air quality would occur if a proposed Refuge action results in the degradation of the existing level of service on adjacent roadways. Significant cumulative effects would occur if the “de minimis” (minimum) thresholds developed by the EPA for proposed Federal actions in a non-attainment area are exceeded (refer to Section 3.3.7).
- **Noise** – An action that generates noise levels at the property line in excess of the affected city’s noise standards would be considered a significant adverse effect. Indirect noise impacts to sensitive wildlife are addressed under Effects to Wildlife (Section 4.4).

#### **4.2.1 Sweetwater Marsh Unit**

##### **4.2.1.1 Alternative A – No Action**

###### **4.2.1.1.1 Effects to Topography/Visual Quality**

###### **Habitat and Wildlife Management**

Under the no action alternative annual disking and general site preparation to maintain suitable nesting habitat for California least tern and western snowy plover on the D Street Fill would continue, as would other habitat and wildlife management actions, such as trash clean-up, periodic control of invasive plants, and general control of public access. None of these activities would result in any significant direct or indirect adverse effects to the existing site topography or visual quality. Some minor beneficial effects to visual quality would result from removing unsightly trash and controlling weeds along access points into the Refuge.

As described in Section 2.2.2.1, until 2010 restoration of the mitigation leasehold overlays could occur under this or any of the other alternatives proposed for the Sweetwater Marsh Unit. Such actions would be initiated by an entity other than the Service and no restoration plans are currently available for these sites. To restore areas such as the D Street Fill to tidal influence would result in changes in the landform. Specifically, the area would have to be excavated to achieve elevations that support intertidal habitat. These changes are not anticipated to result in any significant adverse impacts to topography or visual quality; however, without the specific restoration details, an analysis of potential effects is not possible at this time. Subsequent environmental analysis consistent with NEPA would be required when specific details regarding the restoration plans are provided to the Refuge Manager for review and approval.

###### **Public Use**

The continuation of the public use programs currently conducted on the Sweetwater Marsh Unit would not result in any significant adverse effects to topography/visual quality.

#### **4.2.1.1.2 Effects to Geology, Soils, and Agricultural Resources**

##### **Habitat and Wildlife Management**

No unique geologic features occur within this Unit and no active faults have been identified in the immediate area. The site would however be subject to seismic ground shaking or seismically induced liquefaction in the event of a large magnitude earthquake on one of the faults in the San Diego region. Therefore, the access road and other structures present on this Refuge Unit could sustain damage in the event of such an earthquake. Under this alternative, no new structures are proposed; therefore, hazards and the potential for structural damage due to seismic ground shaking or seismically induced liquefaction in the event of an earthquake would remain unchanged and are considered low.

No significant changes to soils or sediments are anticipated as a result of the continuation of current management actions. The potential for low levels of erosion and sedimentation resulting from ground disturbing activities (disking and removal of annual weedy plants) associated with nest site preparation at the D Street Fill would continue, but are not considered significant.

No significant agricultural resources were identified on this Refuge Unit; therefore, the implementation of this alternative would not adversely affect agricultural resources.

##### **Public Use**

No adverse or beneficial effects related to geology, soils, or agricultural resources would result from the continuation of the current public use activities conducted on this Refuge Unit.

#### **4.2.1.1.3 Effects to Hydrology and Water Quality**

##### **Habitat and Wildlife Management**

Implementation of the no action alternative would maintain the current hydrologic conditions within the Refuge Unit, resulting in the continuation of ongoing sedimentation within the primary tidal channel in Paradise Marsh, as well as within the various tidal channels in Sweetwater Marsh. No changes in the current flood characteristics of the area, including flood frequency or duration, would result. The entire area within the Refuge Unit that supports salt marsh habitat, as well as the northwestern most portion of Gunpowder Point and the easterly end of D Street Fill, would continue to be subject to flooding in a 100-year storm event. As no changes in the current conditions are proposed by the Service, no significant effects related to hydrology are anticipated.

Potential future restoration of the mitigation leasehold overlays would require additional hydraulic and water quality analysis to evaluate the impacts, if any, of restoration within the floodplain or intertidal zone on uses in the vicinity of the restoration project.

The control of invasive plant species would continue to be implemented on this Refuge Unit. Control would involve mechanical removal and the periodic application of herbicides, particularly in the disturbed upland areas that border the marsh. Although mechanical removal has the potential to expose soils to wind and water erosion, this activity would be to the use of hand tools and would focus on individual plant removal, rather than the removal of large areas of vegetation. Therefore, the continuation of this control method is not expected to introduce additional sediments into the marsh complex. The use of herbicides to control invasive plants also poses several environmental risks, including drift, volatilization, persistence in the environment, water contamination, and harmful effects to wildlife (Bossard *et al.* 2000). The potential for such risks under this alternative are



considered minimal due to the types and limited quantities of herbicides used and the precautionary measures taken during application.

#### **Public Use**

No adverse effects to hydrology or water quality would result from the continuation of the current public use programs.

#### **4.2.1.1.4 Effects to Air Quality**

##### **Habitat and Wildlife Management**

Factors that could affect air quality, such as visitor-related traffic generation, would not change from current conditions. Therefore, implementing Alternative A would result in no significant changes over existing conditions.

Potential future restoration of the mitigation leasehold overlays would require additional air quality analysis, as temporary increases in air emissions would occur during excavation and other construction related activities.

#### **Public Use**

Maintaining the current public use programs would not adversely affect air quality.

#### **4.2.1.1.5 Effects to Noise**

##### **Habitat and Wildlife Management**

The continuation of current activities on the Refuge would not generate noise of sufficient volume to impact any existing or future sensitive receptors in the general vicinity; therefore, no significant adverse noise impacts are anticipated as a result of implementing Alternative A.

#### **Public Use**

The continuation of the public use programs currently conducted on the Sweetwater Marsh Unit would not alter the existing noise conditions within the vicinity of this Refuge Unit.

### **4.2.1.2 Alternative B – Habitat Enhancement/Interpretation**

#### **4.2.1.2.1 Effects to Topography/Visual Quality**

##### **Habitat and Wildlife Management**

Conducting the habitat and wildlife management activities currently occurring on the Sweetwater Marsh Unit, as well as the additional activities associated with mapping endangered, threatened, and sensitive plant species; monitoring of federally listed endangered and threatened avian species; and expanding efforts to control invasive plant species would not result in adverse effects to topography or visual quality.

##### **Habitat Enhancement**

Alternative B would involve the design and implementation of several habitat enhancement activities that would alter the existing landform within this Unit. These changes are not considered significant because the landforms to be altered were created as the result of previous human disturbance. Specific changes include the partial or complete removal of fill from an abandoned roadbed that extends east/west across Sweetwater Marsh; the potential removal of an old berm constructed between San Diego Bay and the southern tip of Sweetwater Marsh; the installation of an additional culvert under the roadway currently used to access Gunpowder Point; and lowering or removing the weir at the southern end of

Paradise Marsh. None of these proposals would adversely alter the natural landform on the Refuge, block public views, or degrade the visual quality of the area.

The proposed expansion of the area subject to annual disking and general site preparation on the D Street Fill to accommodate seabird nesting would not adversely affect topography, natural landform, or visual quality.

#### **Public Use**

The addition of new interpretive signage in the vicinity of Paradise Marsh and the F&G Street Marsh would not result in any significant adverse effects to topography/visual quality.

#### **4.2.1.2.2 Effects to Geology, Soils, and Agricultural Resources**

##### **Habitat and Wildlife Management**

No adverse effects to geology, soils, and agricultural resources from the implementation of the management activities proposed under Alternative B are anticipated.

##### **Habitat Enhancement**

The existing hazards and potential for structural damage to the main access road and other structures as a result of seismic ground shaking or seismically induced liquefaction would not change as a result of the enhancement proposals included under this alternative. As no significant agricultural resources were identified within this Refuge Unit, this alternative would not adversely affect agricultural resources.

#### **Public Use**

No adverse or beneficial effects related to geology, soils, or agricultural resources would result from the implementation of the public uses proposed under this alternative.

#### **4.2.1.2.3 Effects to Hydrology and Water Quality**

##### **Habitat and Wildlife Management**

Expanding invasive plant species control, as described for Alternative B, would not substantially alter the conclusions presented under Alternative A within respect to hydrology and water quality.

##### **Habitat Enhancement**

The proposed improvements to tidal circulation and the expansion of seabird nesting opportunities would alter the hydrology and could affect water quality within this Refuge Unit. Specifically, changes in wetland hydrology would result from the removal of fill material that currently impedes tidal circulation through Sweetwater Marsh. The reconnection of the historic tidal channels in this area would be accomplished by removing an abandoned roadbed, installing an additional box culvert within the main access road, and possibly removing a berm located between the bay and the southern end of Sweetwater Marsh. By removing these existing impediments to tidal flow, new secondary and tertiary tidal channels could develop over time that would improve overall habitat quality within the marsh. Removal of the abandoned roadbed could also improve circulation of freshwater flows through the southern end of Sweetwater Marsh during storm events. All of these proposals would provide significant beneficial effects to hydrology and water quality as a result of improved tidal circulation within this Refuge Unit.

The excavation required to implement these improvements could result in temporary increases in turbidity within the tidal channels and the addition of sediments into the channels during excavation. To remove the abandoned roadbed fill that crosses Sweetwater Marsh (see Figure 2-3), it would be necessary to excavate an estimated 7,500 cubic yards of fill material using conventional land based construction equipment. Short term adverse impacts to water quality, would be minimized by scheduling construction activities to avoid periods of extreme high tide. Best Management Practices (BMPs) would also be implemented to minimize that potential for sedimentation into the adjacent channels during excavation. Construction staging and access routes would be located in stable upland areas; silt fences would be installed around construction areas; and, if necessary, cofferdams would be used to minimize erosion and sedimentation into the adjacent marsh. The implementation of these measures would reduce the potential for increased sedimentation to below a level of significance.

Installing an additional box culvert under Gunpowder Point Drive could also result in temporary increases in turbidity and sedimentation within the adjacent marsh channels. To minimize these impacts, use of construction vehicles would be confined to the existing roadway and construction would be timed to avoid extreme high tides. In addition, silt fencing and, if necessary, cofferdams would be installed to minimize impacts related to erosion and sedimentation. Revegetation of any disturbed areas would occur immediately upon completion of construction. The implementation of these measures would reduce the potential for water quality impacts to below a level of significance.

To avoid any unanticipated impacts to water quality, prior to excavation, a site assessment would be completed to determine the presence or absence of contaminants within the fill material to be removed. If contaminants are present, appropriate remediation would be implemented prior to or in association with the proposed excavation.

This alternative also contemplates the removal of a berm previously constructed between the bay and the southern end of Sweetwater Marsh (see Figure 2-3). Prior to developing construction plans to implement this proposal, a hydrological assessment of the proposal would be conducted to determine how this action would alter the existing marsh hydrology. Construction methods intended to minimize impacts related to erosion and sedimentation would be incorporated into future grading plans. The amount of excavation required to accomplish this action is unknown at this time. If after completing the final restoration plans, new impacts are identified, additional analysis under NEPA would be required.

To improve tidal circulation in Paradise Marsh, this alternative also proposes to lower or remove an existing weir located at the terminus of Paradise Creek. Previous hydrologic monitoring in this area established that the weir is causing tidal damping and sediment deposition in the marsh's main tidal channel. Lowering the weir by as much as 2.5 feet would avoid any further deposition (Philip Williams & Associates 1993, 1995). Altering the existing weir could result in limited short-term impacts related to increased sedimentation primarily within the flood control channel. However, the benefits to the marsh in terms of improved tidal circulation would far exceed the short-term adverse effects of increased sedimentation that could occur immediately following project implementation.

Lowering or removing the weir could also result in changes to the existing groundwater conditions within the marsh. Specifically, the direction in which groundwater currently flows could be reversed, with flows that currently move toward the north returning to a more natural condition in which groundwater would flow toward the bay. Because of the

potential presence of contaminants in the groundwater upstream of this Refuge Unit, this reversal in flow could introduce contaminants into the marsh. Prior to implementing this proposal, additional analysis of the groundwater conditions upstream of Paradise Marsh would be conducted to ensure that no contaminants are inadvertently introduced into the marsh. All contaminants analysis would be conducted in coordination with the Service's Division of Environmental Contaminants.

Habitat enhancement is also proposed for a portion of the D Street Fill. Under this alternative, the area prepared for California least tern and western snowy plover nesting would be expanded from 17 acres to 30 acres and the slopes along the southwestern edge of the D Street Fill would be recontoured to reduce the slope gradient between the nesting area and the adjacent marsh. Although this could expose an additional 13 acres of soil to wind and water erosion, the material on the D Street Fill generally consists of sandy soils that have a low susceptibility to erosion. In addition, the site is relatively flat, which further reduces the potential for measurable erosion. Increasing the area prepared for seasonal nesting is not expected to significantly increase erosion or sedimentation into wetlands. Recontouring the eroded slopes would reduce erosion and sedimentation onto the adjacent mudflats. These improvements would provide modest benefits to the goal of protecting water quality in this portion of the bay.

#### **Public Use**

No adverse effects to hydrology or water quality would result from the implementation of the public uses proposed under this alternative.

#### **4.2.1.2.4 Effects to Air Quality**

##### **Habitat and Wildlife Management**

No adverse effects to air quality from the implementation of the management activities proposed under Alternative B are anticipated.

##### **Habitat Enhancement**

The San Diego County APCD has not established specific criteria for assessing air quality impacts related to land excavation activities, such as those required to implement the proposed enhancement projects. Although limited in duration, the emissions from these types of activities can cause adverse air quality impacts if they are large enough in scope. Rule 1501 of the APCD Rules and Regulations (as described in Section 3.3.7) states that a conformity determination is required for each pollutant where the total direct and indirect emissions in an area caused by a Federal action would equal or exceed acceptable rates.

The construction activity required to implement the proposed enhancement projects would produce temporary increases in combustive and fugitive dust ( $PM_{10}$ ) emissions as a result of the operation of mobile earthmoving and construction equipment. Each of the proposed actions would be accomplished in a relatively short period of time (some lasting a few weeks, while others not exceeding two months in duration). The total emissions generated from the combined enhancement proposals are not expected to exceed the rates established for Federal actions. However, additional analysis would be conducted for these proposals once specific engineering plans have been developed. The requirements of Rule 1501 would only be applied to this proposal if it is determined that the rates established for Federal action would be exceeded.

#### **Public Use**

Implementing the public uses proposed under Alternative B would not result in any adverse effects to air quality.

#### **4.2.1.2.5 Effects to Noise**

##### **Habitat and Wildlife Management**

The implementation of the habitat and wildlife management activities proposed under Alternative B would not result in any increases in the current noise levels generated from within this Refuge Unit, therefore, no adverse effects related to noise are anticipated.

##### **Habitat Enhancement**

The construction activity associated with the proposed enhancement projects would temporarily increase noise levels in the surrounding area; however, the noise would not be of sufficient volume to impact any existing or future sensitive receptors (e.g., residential housing, commercial development) in the general vicinity of the Refuge.

#### **Public Use**

Implementing the public uses proposed under Alternative B would not alter the existing noise conditions within the vicinity of this Refuge Unit.

### **4.2.1.3 Alternative C – Habitat Restoration/Enhance Public Use (Preferred Alternative)**

#### **4.2.1.3.1 Effects to Topography/Visual Quality**

##### **Habitat and Wildlife Management**

The habitat and wildlife management actions proposed under Alternative C expand upon the proposals already addressed under Alternative B by incorporating proposals to improve habitat conditions for salt marsh bird's beak and to participate in local and regional watershed planning programs. Implementing these management activities would not result in any significant adverse effects to topography/visual quality.

##### **Habitat Restoration**

The habitat enhancement activities described in Alternative B would also be implemented under this alternative. As stated above, the landform alterations associated with these enhancements are minor and would not adversely impact the area topography or visual quality. In addition to habitat enhancement, Alternative C also includes a number of habitat restoration proposals. These restoration proposals would result in minor modifications to the existing topography within some portions of the Refuge. The most extensive of these alterations would occur in association with the future restoration of approximately 13 acres at the eastern end of the D Street Fill. Restoring this area to intertidal habitat would involve lowering the site from 13 feet MLLW to an elevational range of between -1 feet MLLW and +9 feet MLLW. The excavation would convert the existing landform from a relatively flat surface to a gently sloping marsh plain. The resulting landform would be more representative of the historic landscape and would not be considered a significant adverse effect.

Salt marsh restoration is also proposed at the northern end of the F&G Street Marsh and the northern edge of Gunpowder Point (refer to Figure 2-4). The minor changes in the existing landform associated with these proposals would result in a landform that more closely resembles the historic topographic character of the area. These changes are not considered significant in terms of landform alteration or visual quality.

### **Public Use**

No significant adverse effects to topography/visual quality are anticipated as a result of implementing the public use program proposed under this alternative.

#### **4.2.1.3.2 Effects to Geology, Soils, and Agricultural Resources**

##### **Habitat and Wildlife Management**

No adverse effects to geology, soils, or agricultural resources are anticipated as a result of implementing the habitat and wildlife management activities proposed under Alternative C.

##### **Habitat Restoration**

The existing hazards and potential for structural damage to the Refuge's main access road and other structures as a result of seismic ground shaking or seismically induced liquefaction would remain unchanged.

Restoration of a portion of the D Street Fill to coastal wetlands would result in the need to dispose of the soil removed during excavation. If the excavated material consists of clean sand of an appropriate grain size, it would most likely be used for beneficial uses, such as nesting substrate for tern nesting areas or for beach replenishment. If the material is not appropriate for these uses, other potential disposal options include off-site disposal within an approved development project, offshore disposal within an approved ocean disposal site, or disposal within an existing landfill. The actual disposal option selected would be dependent upon the structural and chemical characteristics of the soil, the availability of off-site disposal sites, and the cost of disposal.

No significant agricultural resources were identified on Refuge lands; therefore, the implementation of this alternative would not adversely affect agricultural resources.

### **Public Use**

No significant adverse effects to geology, soils, or agricultural resources are anticipated as a result of implementing the public use program proposed under this alternative.

#### **4.2.1.3.3 Effects to Hydrology and Water Quality**

##### **Habitat and Wildlife Management**

The effects to hydrology and water quality of implementing the proposed habitat and wildlife management actions would be the same as described for Alternative B.

##### **Habitat Restoration**

As discussed under Alternative B, changes in wetland hydrology would result from the implementation of enhancement proposals intended to improve tidal circulation within the Refuge. These changes would result in moderate long-term benefits to the Refuge's salt marsh habitat. There is, however, the potential for short-term adverse impacts associated with the excavation required to implement these improvements. Such impacts, which could result from temporary increases in turbidity and sedimentation within tidal channels, would be minimized through the implementation of BMPs during construction.

The effects to hydrology and water quality from implementing the proposed restoration projects would be similar to those previously described for habitat enhancement under Alternative B. As noted in Chapter 2, the restoration proposals are preliminary in nature; no specific engineering has been conducted. Therefore, the analysis of environmental

consequences is somewhat generic. Additional analysis would be conducted following the completion of specific restoration plans for each site. If new impacts are identified during final restoration planning, additional review under NEPA would be conducted.

Salt marsh restoration of approximately 13 acres is proposed for the east end of the D Street Fill. This restoration could occur in one action or as a series of actions and would involve excavating and/or dredging to achieve elevations suitable for establishing salt marsh habitat. These activities would result in short-term increases in suspended sediments and turbidity levels in the open water and tidal channel habitats adjacent to the restoration area. Such impacts would be temporary and could be minimized through appropriate BMPs, including the use of berms, silt curtains, cofferdams, and similar construction techniques.

Another two acres of salt marsh restoration is proposed along the northern edge of Gunpowder Point where fill was pushed into the marsh sometime in the past to expand the area available for crop production. Grading activities would involve removing the fill and restoring to area to elevations ranging from approximately +6 MLLW to +3.5 MLLW. To minimize water quality impacts related to sedimentation and turbidity, a silt curtain or other appropriate barrier would be maintained around the perimeter of the excavation area during grading.

Contaminant levels present in some samples taken from the sediments and fill materials located within the F&G Street Marsh indicate a potential threat to water quality within the marsh and the bay. Exposing these soils to tidal action could result in the release of contaminants into the water column. To avoid such impacts, future restoration plans would include measures to remediate contaminants where appropriate, as well as protect adjacent waters from potential contamination during excavation. All restoration planning for this area would be coordinated with the Service's Division of Environmental Contaminants.

Impacts to hydrology and water quality from the restoration of upland and upland transition habitat on Gunpowder Point are not expected to be significant. Restoring this area would not require extensive grading. The potential for erosion and sedimentation into the adjacent marsh would be minimized by placing a silt curtain around the perimeter of the restoration area.

A site assessment would be completed prior to any excavation to determine the presence or absence of environmental contaminants. This measure would be implemented to avoid significant long-term impacts to water quality from any of the proposed enhancement or restoration projects. If contaminants are present, appropriate remediation would be implemented prior to or in association with the proposed excavation.

#### **Public Use**

The changes to the existing trail system proposed under Alternative C (i.e., construction of new trail segments, the closure of some existing trails, and/or the installation of new interpretive elements) could temporarily expose the soil to water and wind erosion. Such exposures would be minimal and would not represent a significant adverse effect. Long-term erosion problems associated with a redesigned trail system would be avoided by implementing sound trail construction techniques.



#### **4.2.1.3.4 Effects to Air Quality**

##### **Habitat and Wildlife Management**

The effects to air quality of implementing the proposed habitat and wildlife management actions would be the same as described for Alternative B.

##### **Habitat Restoration**

The construction activity required to implement restoration under this alternative would produce temporary increases in combustive and fugitive dust (PM<sub>10</sub>) emissions as a result of the operation of mobile earthmoving and construction equipment. Each of the projects would be relatively small in scope and would most likely be implemented in phases; consequently, the total emissions generated from the combined enhancement and restoration proposals are not anticipated to meet or exceed the emission limits described in Rule 1501 of the APCD Rules and Regulations.

##### **Public Use**

The expanded opportunities for public use would result in some increases in car and bus trips to and from the Refuge Unit; however, the majority of these trips would occur during off-peak traffic hours. Therefore, the increase in trips would not be expected to adversely affect the current level of service on the surrounding street system, nor would it result in the generation of air emissions that would meet or exceed the standards established in Rule 1501 of the APCD Rules and Regulations.

#### **4.2.1.3.5 Effects to Noise**

##### **Habitat and Wildlife Management**

The management proposals included within this alternative would not increase noise levels within or adjacent to this Refuge Unit.

##### **Habitat Restoration**

The construction activities associated with proposed restoration would temporarily increase noise levels in the vicinity of the projects; however, the noise generated by the construction equipment would not produce noise of sufficient volume to impact sensitive receptors in the general vicinity of the Refuge Unit. A potential exception would be restoration activities within F&G Street Marsh where planning for future development is currently underway. If uses sensitive to elevated noise levels (e.g., residential development) are constructed in proximity to the F&G Street Marsh, construction noise from restoration activities could adversely affect these uses.

In general, construction equipment, such as backhoes and dump trucks, generate an hourly average noise level of about 85 dBA at an equivalent distance of 50 feet, while front-end loaders and cranes with buckets generate a noise level of about 90 dBA at 50 feet. An electrified hydraulic dredge would be expected to produce lower noise levels, somewhere in the range of 72 to 75 dBA at 50 feet. The noise levels from such equipment would reduce at the rate of about 6 dBA with each doubling of the distance from a sensitive receptor, such as adjacent residences.

Additional evaluation of potential noise impacts would be conducted prior to the implementation of restoration at the F&G Street Marsh. Mitigation measures would be implemented to reduce excessive noise levels to below a level of significance if it is determined that noise levels at the property line would exceed accepted standards for adjacent development (refer to Section 3.3.9). Such mitigation could include ensuring that

all internal combustion engine-driven equipment is properly muffled, construction staging areas are located an adequate distance from any residential or commercial property lines, and, if necessary, temporary noise barriers are installed between the restoration site and sensitive receptors to minimize the impacts of construction noise on adjacent uses.

#### **Public Use**

The public use proposals included under Alternative C would not result in any changes to the existing noise levels within or adjacent to this Refuge Unit, therefore, no adverse effects related to noise are anticipated.

### **4.2.2 South San Diego Bay Unit**

#### **4.2.2.1 Alternative A – No Action**

##### **4.2.2.1.1 Effects to Topography/Visual Quality**

##### **Habitat and Wildlife Management**

Under this alternative, no significant alteration of the existing landform would occur. Annual mowing of the abandoned agricultural fields on the Otay River floodplain to reduce the threat of wildfire and the spread of invasive plant species would continue; however, these activities would not adversely affect site topography or visual quality.

##### **Habitat Enhancement**

Two enhancement projects intended to improve nesting and foraging opportunities for the California least tern are included within this alternative. These projects are also components of all of the action alternatives (refer to Sections 1.7.3 and 2.3.1.1). The first project, levee surface enhancement, would involve placing sand on some levee tops to support seabird nesting. This activity would occur on existing manmade structures and would have little or no effect on site topography or visual quality.

The second project, which would improve foraging habitat for the California least tern, would involve breaching one of the salt ponds, most likely Pond 28 or 29, to facilitate tidal exchange within all or a portion of the pond. This action would have little effect on the topography or visual quality of the site, although the appearance of the affected pond would change from that of an open water or salt-crusted area to an area with water levels that vary with the tides.

#### **Public Use**

Continuing to allow fishing and recreational boating within the Refuge boundary and supporting the current opportunities for wildlife observation and environmental education would have no effect on topography or visual quality. In addition, no changes to the existing topography or visual quality on this Refuge Unit would occur as a result of continuing to produce salt within the salt ponds.

##### **4.2.2.1.2 Effects to Geology, Soils, and Agricultural Resources**

##### **Habitat and Wildlife Management**

No unique geologic features or active faults occur within the South San Diego Bay Unit; however, existing structures would be subject to seismic ground shaking or seismically induced liquefaction in the event of a large magnitude earthquake on one of the faults in the San Diego region. In such an event, the existing salt pond levees could sustain damage, although the potential for damage is considered low.

No significant soil alteration is proposed under this alternative. In addition, the implementation of this alternative would not adversely affect that portion of the Otay River floodplain that is designated as Prime Farmland by the California Department of Conservation (2000).

#### **Habitat Enhancement**

The depth of the sand to be placed on the levees under this alternative would be limited to approximately six to ten inches; therefore, this activity would have no effect on the stability of the existing levees. No adverse effects related to geology, soils, or agricultural resources are anticipated.

#### **Public Use**

The continuation of existing uses on this Refuge Unit would not result in any significant adverse effects to geology, soils, or agricultural resources.

#### **4.2.2.1.3 Effects to Hydrology and Water Quality**

##### **Habitat and Wildlife Management**

Habitat and wildlife management activities that would be implemented under this alternative would not result in any changes to the current water quality or hydrologic characteristics within the Refuge or the surrounding areas. The salt ponds, Otay River floodplain, and adjacent buildings to the south of the Refuge would continue to be subject to inundation during a 100-year flood. In addition, the southern outer levees of the salt ponds would be subject to overtopping in a 10-year or greater storm event (*Rick Engineering 1987*).

Some short-term effects to water quality could occur as a result of routine maintenance and occasional repairs to the outer levees. These effects would be limited in scope and short in duration, therefore, no significant adverse impacts are anticipated.

#### **Habitat Enhancement**

No adverse effects to bay waters or the adjacent channels that drain into the bay are anticipated from the placement of sand on the levees as these activities would be confined to the interior of the salt works.

Restoring foraging habitat could result in minor, temporary impacts to water quality immediately following pond breaching, as hypersaline water is introduced into the bay. The quality of hypersaline water discharged into the bay would be small and the effects of the increased salinities would be short lived, therefore, no significant adverse effects to water quality are anticipated.

#### **Public Use**

Recreational boating in the South San Diego Bay Unit is limited due to the shallow depths of the water; therefore, the continuation of boating at the present low levels would not adversely affect water quality in the bay. The current solar salt operation does not result in any discharge into the bay; therefore, no impacts to water quality are anticipated from the continuation of this use.

#### **4.2.2.1.4 Effects to Air Quality**

##### **Habitat and Wildlife Management**

The operation of maintenance equipment (e.g. light trucks, mowers, and other landscape equipment), which generate low levels of air emissions, would not increase from current conditions. Rule 1501 of the APCD Rules and Regulations states that future activities conducted in a similar scope and operation to activities currently being conducted would result in no air emission increases or if an increase in emissions does occur, it would be de minimis. As a result, no significant adverse impacts to air quality are anticipated under this alternative.

##### **Habitat Enhancement**

Air emissions generated by dump trucks and small bobcat tractors required to transport and place sand on the levees would be minimal and would not meet or exceed the standards set forth in Rule 1501 of the APCD Rules and Regulations.

Restoring foraging habitat under this proposal could involve removal of any salt from the pond surface, excavation or ripping of any gypsum crust, and other minor earthwork necessary to connect the pond to the bay to facilitate tidal exchange. These activities would be temporary and limited in scope; therefore, no adverse air quality impacts are anticipated.

##### **Public Use**

The limited recreational boating that occurs within this Refuge Unit would not adversely affect air quality within the region.

#### **4.2.2.1.5 Effects to Noise**

##### **Habitat and Wildlife Management**

The operation of maintenance equipment, which generates low levels of noise, would not increase from current conditions. As a result, no significant adverse impacts related to noise are anticipated under this alternative.

##### **Habitat Enhancement**

Noise produced during the operation of construction equipment used to enhance nesting habitat for least terns at the salt works or to breach a pond levee to improve foraging habitat would not exceed adopted noise standards at the Refuge boundary; therefore, no significant noise impacts would be anticipated.

##### **Public Use**

Boating activity within the Refuge Unit is subject to an existing five mph speed limit; therefore, excessive noise from this activity is not anticipated.

### **4.2.2.2 Alternative B –Enhance Nesting Habitat**

#### **4.2.2.2.1 Effects to Topography/Visual Quality**

##### **Habitat and Wildlife Management**

The control of invasive plant species along the Otay River channel and the subsequent planting of appropriate native vegetation is not expected to result in any adverse effects to site topography or visual quality. The control of accumulated fishing line and other debris around the outer levees could provide minor beneficial effects related to visual quality.

### **Habitat Enhancement**

Implementing the nesting enhancements proposed under this alternative would involve importing fill material onto the site to widen and/or recontour the existing levees and create several new nesting areas within the ponds. Estimates were developed based on the enhancement proposals illustrated in Figure 2-7 (refer to Section 2.3.2.2 and Tables 2-5 and 2-6) to gain a general understanding of the extent of material that would be required to achieve these enhancements. The actual volumes of fill material and sand required to implement these enhancements would be determined in association with the development of final restoration plans.

An estimated 300,000 to 500,000 cubic yards of fill material would be required to widen some levees, recontour the side slopes of other levees, and build new nesting areas in certain salt ponds. An additional 65,000 cubic yards of clean sand would have to be imported to cap the new and enhanced nesting areas. The majority of this material would be placed in the water area of the ponds; therefore, the total area of upland (exposed land) within the salt works would increase by only 2 to 3 percent, representing a relatively minor change in the site's topography and visual quality as viewed from the areas surrounding the Refuge. No significant impacts related to landform alteration or visual quality are therefore anticipated.

The effects of implementing required foraging habitat for the California least tern would be the same as discussed above.

### **Public Use**

Under this alternative, no changes would occur to the public use program currently implemented on the Refuge; therefore, as in Alternative A, no adverse effects to topography or visual quality, are anticipated. Solar salt production would continue in essentially the same configuration as described for Alternative A, although minor changes in the configuration of the salt ponds are proposed to facilitate nesting enhancements. As described in Alternative A, no adverse effects to topography or visual quality would result from the continued operation of the salt works.

#### **4.2.2.2 Effects to Geology, Soils, and Agricultural Resources**

##### **Habitat and Wildlife Management**

The control of invasive plant species along the Otay River channel would not result in any adverse effects to site geology, soils, or agricultural resources.

### **Habitat Enhancement**

This alternative proposes to add fill material and capped with a layer of sand to various ponds and levees within the salt works to enhance nesting opportunities. These materials would be placed on levees that are composed of hydraulic and non-hydraulic fill soils; soils that have not been tested for proper compaction during their placement (*GEOCON 1985*). Fill material needed to create nesting sites and widen levees would be placed on areas underlain by bay deposits (refer to Section 3.3.3.2.) characterized by high compressibility and low shear strength. These soil characteristics could result in some settlement following placement of the fill on the levees, which could lead to the instability of the submerged levee slopes.

The amount of settlement expected to occur following grading would be a function of how thick the existing compressible layer is, how compressible the layer is, and how heavy the new vertical load (weight of the new fill) would be (*GEOCON 1985*). Slope stability is

related in part to the steepness of the slope; the flatter the slope (3:1 or flatter), the less likely the slope would be subject to deep-seated failure. These factors would be considered during final engineering to ensure that the intended shape and elevation of the new and enhanced nest sites would be achieved. In addition, a qualified geologist would be retained to review the final enhancement plans and provide recommendations specific to the proposed enhancement activities.

Placement of fill material and sand within the salt works could result in some sedimentation into the ponds; however, no adverse effects to the adjacent bay or Otay River channel are anticipated. To avoid short or long-term erosion into the ponds and additional settlement of the newly created nesting areas, the suitability of the proposed fill material for use within the ponds would be determined prior to acquisition of the material. The shear strength of the fill material would also be considered and the slope gradient of the fills would be planned accordingly. The implementation of the various measures described above would reduce potential adverse effects related to geology and soils to below a level of significance.

The site would continue to be subject to seismic ground shaking or seismically induced liquefaction in the event of a large magnitude earthquake. Based on existing soil characteristics, the potential for liquefaction in the vicinity of the salt works would remain high; however, the potential for a significant seismic event that would trigger liquefaction in this area is considered low.

No Prime Farmland has been identified within the salt works; therefore, the completion of nesting enhancements would not adversely affect agricultural resources.

#### **Public Use**

No adverse effects to geology, soils, or agricultural resources are anticipated, as no changes in existing conditions would result from the implementation of this alternative.

#### **4.2.2.2.3 Effects to Hydrology and Water Quality**

##### **Habitat and Wildlife Management**

The removal of invasive plants, particularly through mechanical removal, could expose small areas of soil to wind and water erosion. The result could be a small, temporary increase in sedimentation within the river channel. Such effects would be minimal due to the limited area to be impacted and the limited time that the soil would be unvegetated. Significant adverse effects related to water quality are therefore not anticipated. Additionally, the minor landform alterations associated with invasive plant removal along the river channel would have not adversely affect the existing hydrologic conditions within the Refuge Unit or the surrounding area.

The use of herbicides to control invasive plants could adversely affect the environment as a result of pesticide drift, volatilization, persistence in the environment, water contamination, and harmful effects to wildlife (*Bossard et al. 2000*). The potential for such risks is considered low due to the types and limited quantities of herbicides to be used and the precautionary measures to be taken during application.

##### **Habitat Enhancement**

The activities associated with these enhancements would be confined to the interior of the salt works; therefore, no impacts to the surrounding water quality or the hydrological

characteristics of the floodplain are anticipated. Large portions of the Refuge Unit and many of the adjacent properties would continue to be subject to flooding and the outer levees located along the southern edge of the salt works would continue to be subject to overtopping during significant storm events within the Otay River drainage basin.

#### **Public Use**

No changes would occur to the public use program currently implemented on the Refuge; therefore, as in Alternative A, no adverse effects to hydrology or water quality are anticipated. In addition, solar salt production would continue in essentially the same configuration as described for Alternative A, therefore, no adverse effects to hydrology or water quality would result from the continued operation of the salt works.

#### **4.2.2.2.4 Effects to Air Quality**

##### **Habitat and Wildlife Management**

The removal of invasive plants, particularly through mechanical removal, could expose small areas of soil to wind erosion; however, the contribution of particulate matter into the air from this activity would be minimal. No significant adverse effects related to air quality are therefore anticipated. Additionally, because invasive plant control would be implemented for only a few weeks out of the year, no significant adverse impacts related to air quality are anticipated.

##### **Habitat Enhancement**

As previously stated, specific criteria for assessing air quality impacts related to land excavation activities have not been established by the APCD; however, Rule 1501 of the APCD Rules and Regulations states that a conformity determination is required for each pollutant where the total direct and indirect emissions caused by a Federal action would equal or exceed acceptable rates.

The construction activity required to implement the proposed enhancement projects would involve importing 300,000 to 500,000 cubic yards of fill material and an estimated 65,000 cubic yards of clean sand. This would generate 18,250 to 28,250 truck trips to the site over the life of the project and would require the use of several construction vehicles, such as small dump trucks, skip loaders, and/or small bobcat tractors, to distribute the material throughout the site. The enhancements, which would be completed in a relatively short period of time (some lasting a few weeks, while others not exceeding six months in duration), would result in temporary increases in combustible and fugitive dust (PM<sub>10</sub>) emissions. The total emissions generated as a result of implementing the proposed enhancements (refer to Attachment H for more detail) would not meet or exceed the rates established for Federal actions by Rule 1501; therefore, the requirements of Rule 1501 would not apply, and no significant direct or indirect air quality impacts would be expected.

#### **Public Use**

No adverse effects to air quality are anticipated, as no changes in existing conditions would result from the implementation of this alternative.

#### **4.2.2.2.5 Effects to Noise**

##### **Habitat and Wildlife Management**

No significant adverse impacts related to noise are anticipated, as the operation of construction equipment to remove invasive plants would occur away from sensitive noise receptors and would be limited to a few weeks each year.



### **Habitat Enhancement**

At present, no residential development or other sensitive noise receptors are located in proximity to the salt pond levees that are being considered for nesting enhancement. In addition, no residential or commercial development is permitted in the area under the adopted land use plans for the area. The City of Chula Vista is currently working on several redevelopment plans for this area that could result in changes to the current land use designations immediately to the east of the salt works. Specifically, the current industrial designation could be changed to a mix of commercial and residential development. If such uses were to be developed prior to implementing the proposed enhancements, mitigation measure could be required to maintain construction generated noise at the eastern edge of the Refuge at or below the maximum level permitted by the adopted city ordinances. Such measures could include: placing restrictions on when and where trucks and other construction vehicles may enter and exit the salt works; specifying staging areas that are well removed from the property line; and, if deemed necessary, identifying locations where the installation of temporary noise barriers would be installed. The implementation of these measures, if deemed necessary at the time of project implementation, would reduce any potential noise impacts to adjacent sensitive receptors to below a level of significance.

### **Public Use**

No changes in current noise levels would result from the uses permitted under this alternative.

## **4.2.2.3 Alternative C –Enhance and Restore Habitat/Expand Public Uses**

### **4.2.2.3.1 Effects to Topography/Visual Quality**

#### **Habitat and Wildlife Management**

The effects of implementing the habitat and wildlife management actions proposed under Alternative C would be the same as those described for Alternative B.

### **Habitat Restoration**

Alternative C includes two restoration options for the Otay River floodplain and two for the existing salt pond complex.

Otay River Floodplain Restoration Option 1. Under the first restoration option for the Otay River floodplain, approximately 140 acres of disturbed upland would be converted to 60 acres of salt marsh habitat, 20 acres of freshwater wetland habitat, and 60 acres of native upland habitat (see Figure 2-10). The grading proposed to achieve these habitats would alter the existing landform by widening the Otay River channel within its current configuration to approximately four times its current width. This proposal would also involve the lowering of the northern portion of Pond 20A and an additional area to the south of the Otay River channel by 3 to 12 feet, depending upon the existing elevation and type of salt marsh vegetation desired in a given location. To facilitate restoration of salt marsh and freshwater wetland habitat, approximately 723,000 cubic yards of material would be excavated from the floodplain.

Various options are available for the disposal of this excavated material, including:

- disposal of any clean sand for beneficial uses such as surface enhancement of seabird nesting sites or beach replenishment;
- on-site disposal within the Otay River floodplain;

- on-site disposal within the salt works where material would be needed to achieve proposed nesting enhancements or habitat restoration proposals;
- off-site disposal to an approved development site in need of additional fill material;
- ocean disposal in an approved disposal site, such as LA 5; and
- disposal in an approved landfill.

On-site disposal within the Otay River floodplain could be accomplished by spreading the material over the two areas at the eastern end of the Refuge that are proposed for upland restoration. Assuming all of the excavated material were to be placed within the proposed upland areas, approximately 263,000 cubic yards of the material could be disposed on a 22-acre upland site located to the east of the Otay River and an additional 460,000 cubic yards could be disposed on a 39-acre area located just to the west and south of the river. This proposal would raise the elevation of these upland sites by approximately 8 feet. The 8-foot-high perimeter slopes would be constructed at a relatively gentle 4:1 (horizontal to vertical) slope gradient and would include undulating slopes and varied topographic relief to produce a natural appearing landform. It is likely that some of the excavated material could be used to implement the nesting enhancements also proposed under this alternative, reducing the quantity of material to be disposed of on site (refer to Table 2-11). Further, if restoration of the Otay River floodplain is conducted in association with the restoration of the salt ponds, as discussed below, additional excavated material from the Otay River floodplain could be used to achieve the goals of the salt pond restoration. Under this scenario, the amount of material to be deposited within the proposed native upland restoration area would be reduced.

The landform would also be altered by removing and reconstructing the levee that currently separates Pond 20A from the Otay River channel farther to the south to separate the wetlands within the Refuge Unit from the remainder of Pond 20A, which is owned by the Port.

The grading proposed for this area would result in short term visual impacts resulting from vegetation removal and ongoing grading operations. As the site becomes vegetated, its visual quality would be restored. Currently, I-5 is elevated approximately 12 to 13 feet above the Refuge lands to the west. If fill material is disposed on the proposed upland areas to the west of the freeway, the current topographic relief would be reduced to 4 to 5 feet. Through the incorporation of grading techniques intended to mimic the natural topography in the floodplain, the surface of the disposal areas would appear relatively natural as viewed from the adjacent freeway and the change in elevation would not be readily perceivable from the surrounding public right-of-ways. Views of and through the Refuge would not be adversely affected. The grading required to accommodate the proposed restoration would change the existing landform; however, these changes are not expected to result in any significant adverse effects related to landform or visual quality.

Otay River Floodplain Restoration Option 2. Under the second restoration option for the Otay River floodplain, this area would be graded and recontoured to restore approximately 85 acres of salt marsh habitat, 20 acres of freshwater wetland habitat, and 35 acres of upland habitat. A larger portion of the site would be excavated under this restoration option, generating approximately 970,000 cubic yards of material. On- and off-site disposal options similar to those described above could also be implemented under this proposal. For instance, all or a part of the material could be disposed within the Otay River floodplain on the two designated upland sites. If implemented, this proposal could raise these sites by a minimum of a few inches to a maximum of approximately 18 feet.

Landform modifications would involve excavating much of the area located to the south of the existing Otay River channel, including the northern portion of Pond 20A by 3 to 12 feet. These changes in the landform would be readily apparent as much of the weed-dominated uplands to the west of the freeway would be converted to wetlands supporting small trees and shrubs nearest the freeway and low lying marsh vegetation farther to the west. As with Option 1, some short-term impacts to visual quality would occur during and immediately following excavation; however, once the wetland area is revegetated, the visual quality of the site would be restored and in some cases improved.

The significance of the impact of disposing of excavated material on the two designated upland sites would vary depending upon the amount of material that is placed on these sites. No impacts to views of or across the Refuge are anticipated if the sites are raised from a few inches to a maximum of 8 feet above the existing elevations. Raising the sites from 8 feet to approximately 12 feet above the existing elevations would result in some view obstruction after native upland vegetation is established. Raising the sites from 12 to approximately 18 feet above the existing elevation would block previously open westward views from the freeway. Therefore, disposal options that propose raising the existing elevation of one or both of the designated upland areas by more than 8 feet could adversely affect visual quality, as current views of the floodplain and distance bay from the freeway would be obscured or blocked. This impact would be avoided by reducing the height of the new upland areas to a maximum of eight feet or by ensuring that view corridors through the site are maintained. These measures, which would be incorporated into the final restoration design, would reduce potential impacts to visual quality to below a level of significance.

Salt Works Restoration Option 1. The first restoration option being considered for the salt ponds would involve restoring the three ponds located to the west of the Otay River channel (Ponds 10, 10A, and 11). The existing elevations within some of the ponds would be altered to achieve elevations known to support cordgrass-dominated salt marsh habitat. The desired elevations would be achieved by filling some ponds and recontouring (cutting and filling) other ponds. In addition, the ponds would be breached by cutting a 15-foot or wider opening in the outer levee of each pond to facilitate tidal exchange. The alteration of these existing unnatural landforms (salt ponds and levees) would represent relatively minor topographic changes as viewed from the surrounding area. These overall changes to the western ponds would represent neither an adverse nor a beneficial effect on the existing landform.

The appearance of the western ponds following restoration would be changed from that of water-filled ponds to intertidal mudflats or cordgrass-dominated salt marsh covered by water only during periods of tidal inundation. This change in appearance would be most apparent when viewed from SR-75, the Bayshore Bikeway, and the homes immediately to the south of Pond 10. The views from the residences in the vicinity of Pond 10A already include periods of very low water levels. Therefore, the change from current conditions to a situation in which water levels in the pond are regulated by the tides would be insignificant. The effect to the visual quality and aesthetics as a result of opening Ponds 10 and 11 to tidal action could be viewed as adverse by some observers, while others might consider returning the area to a more historical landscape to be a beneficial visual effect of restoration. Based on the significance criteria for determining when an action would result in a significant adverse visual effect (i.e. an action would substantially alter the natural landform or block public views to a public resource), the Service has determined that the

proposed change in appearance of the ponds would not constitute a significant adverse effect on visual quality.

**Salt Works Restoration Option 2.** Under this option, all of the primary ponds on both the west and east side of the Otay River (Ponds 10A and Ponds 10 through 15) would be restored to tidal action. As described for Option 1, some alteration of the elevations within the ponds would occur to create elevations appropriate for the desired habitat types, primarily cordgrass-dominated salt marsh and various levees would be breached to facilitate tidal exchange. No significant effects related to landform alternative would result from this proposal.

Similar to the discussion for Option 1, the visual appearance of the primary ponds would change from bodies of open water to unvegetated mudflats and coastal salt marsh habitat alternating with views of open water during high tide. Although there would be a range of opinions regarding the changed appearance of the ponds, as stated for Salt Works Option 1, the Service has determined that this change is not of a sufficient magnitude to constitute a significant adverse effect.

To protect the restored habitat within the eastern salt ponds from damage during a significant flood event, the outer levees of Ponds 20, 22, and 48 would be reinforced under this option. Reinforcement could involve the construction of a stone revetment along the length of the levee. To reduce the visual appearance of this revetment, as viewed from the Bayshore Bikeway, the stone revetment would be covered with geotextile-reinforced soil and vegetated with native vegetation. This measure would reduce the potential for adverse visual effects to below a level of significance.

### **Public Use**

Several public uses proposed under this alternative, including fishing and wildlife observation, would result in minor permanent physical changes to various areas within the Refuge, primarily the northern levee of Pond 11. These changes would involve some grading and resurfacing of the levee to improve accessibility; recontouring of the levee slopes to provide designated areas for shoreline fishing access; and construction of a viewing platform near the eastern end of the levee. Although these changes would alter the existing character of the levee, no significant adverse effects related to topography, landform alteration, or visual quality are anticipated.

Environmental education and interpretation proposals would involve removal of invasive species, restoration of native vegetation, installation of interpretive elements along the portion of the Bayshore Bikeway that abuts the Refuge boundary, and the possible future development of small interpretive trails along restored habitat areas at the southern edge of the Refuge. None of these proposals are expected to adversely affect visual quality.

Construction of the Otay Valley Regional Trail along the eastern edge of the Otay River floodplain would alter a 10- to 15-foot-wide and 1,000-foot long area to create a relatively level six to eight-foot wide dirt path. This trail would result in only minor impacts to the existing topography and would not be visible from within the Refuge. Therefore, if the trail is constructed, it would not result in any significant adverse effects related to landform or visual quality within the Otay River floodplain.

#### **4.2.2.3.2 Effects to Geology, Soils, and Agricultural Resources**

##### **Habitat and Wildlife Management**

The effects of implementing the habitat and wildlife management actions proposed under Alternative C would be the same as those described for Alternative B.

##### **Habitat Restoration**

**Nesting Enhancements.** The effects to geology and soils from implementing proposed nesting enhancements would be similar to those addressed in Section 4.2.2.2.2. The only difference would be that under this alternative the margins of the proposed nesting areas would be subject to tidal inundation. During final restoration planning, specific measures and/or design features would be developed to minimize the potential for tidal scouring around these nesting areas, as well as to ensure long-term slope stability at the base of the nesting areas.

**Otay River Floodplain Restoration.** The Otay River floodplain is overlain by approximately two to three feet of uncompacted fill soils. Below the fill are relatively soft and potentially compressible alluvial/bay deposits (*GEOCON 1986*). These soil characteristics represent a geotechnical constraint that would be considered during final design. Specifically, the placement of soils generated during excavation onto those areas designated for upland restoration could result in settlement beneath the proposed fills of several inches. In addition, prior geotechnical analysis (*GEOCON 1986*) indicates that the low shear strength of the existing soil conditions could adversely affect the long-term stability of fill slopes constructed on this site, as well as the new channel slopes constructed within the Otay River to accommodate channel widening. No structures are proposed for construction in this area; therefore, the adverse effects of the existing soil conditions in this area would be relatively minor and preliminary geotechnical analysis indicates that by creating slopes with a slope gradient of 4:1 or flatter, the potential for slope failure would be minimized (*GEOCON 1986*).

Final grading elevations within some portions of the floodplain are expected to be at or below the groundwater table; therefore, dewatering measures may be required to ensure soil stability during excavation. The presence of groundwater may also affect the Service's ability to immediately reuse excavated soils, as the soils may be too wet to allow for proper compaction. It may be necessary to dry and mix excavated silty/clay soils with sandier deposits prior to disposal, depending upon the intended use. A qualified geologist would review these and other geotechnical issues prior to project implementation.

The grain size and chemical characteristics of the soils to be excavated would be analyzed to determine what disposal options are available for the excess material if it cannot all be accommodated within the proposed upland areas. Depending upon the results of the soils analysis, much of the material could be used to restore specific salt ponds to cordgrass-dominated salt marsh and any sand encountered could be used to enhance existing and/or proposed nesting areas. Other disposal options include use in approved offsite development sites, disposal at an approved offshore disposal site, or disposal in a landfill.

The City of San Diego's Seismic Safety Study (1995) indicates that the Otay River floodplain possesses a relatively high liquefaction potential. As no structures are proposed within the Otay River floodplain, the potential for liquefaction should not adversely affect the future habitat restoration area provided all graded slopes are maintained at a slope gradient of 4:1 or flatter (*GEOCON 1986*).

Excavation of the Otay River floodplain to restore coastal wetlands and native upland habitat would irreversibly commit lands identified on the 1998 San Diego County Important Farmlands Map as Prime Farmland (*California Department of Conservation 2000*) to nonagricultural use. Although this area was historically cultivated to produce tomatoes and other truck crops, these lands were taken out of production in the 1980s because it was no longer economically feasible to continue agricultural operations at this location. Considering the limited economic feasibility of farming this area combined with the limited size of the parcel, less than 100 acres, the proposed conversion of these lands to wetland habitat is not considered a significant adverse effect with respect to agricultural resources.

Salt Works Restoration. The geotechnical constraints affecting the proposed restoration of the salt ponds would be similar to those addressed for nesting enhancements (Alternative B). In addition, adding fill to the ponds to achieve elevations intended to support cordgrass-dominant salt marsh habitat could result in some settlement beneath the fill. To determine how much settlement would be expected, further soil and geotechnical analysis would be conducted in association with the development of final restoration plans. According to previous geotechnical investigations, the potential for deep-seated failure of submerged slopes, such as those that would be created when a levee is breached, could be minimized by ensuring that all submerged slopes maintain a slope gradient of 3:1 or flatter (*GEOCON 1985*). During completion of the final restoration design, additional analysis would be conducted to determine the actual slopes gradients required to maintain stability, as well as whether armoring of the levee breaches would be necessary to ensure long-term stability. Based on a preliminary review of the existing soil and geotechnical characteristics of the proposed restoration areas, it appears that adequate measures are available to mitigate any adverse effects related to geology and soils to below a level of significance.

No adverse effects to agricultural resources would occur as a result of implementing the restoration options for the salt works.

#### **Public Use**

The existing potential for structural damage as a result of seismic ground shaking or seismically induced liquefaction could adversely affect the proposed observation decks, portions of the pedestrian pathway, and the observation area on the northern levee of Pond 11 should a large earthquake occur in proximity to the Refuge Unit. The potential for such an event is however considered low. Therefore, no significant adverse effects to the proposed public uses are anticipated as a result of existing conditions related to geology or soils.

Although a regional trail could be constructed along the eastern edge of the Otay River floodplain, no significant adverse effects to the agricultural resources present in this area are anticipated.

#### **4.2.2.3.3 Effects to Hydrology and Water Quality**

##### **Habitat and Wildlife Management**

The effects of implementing the habitat and wildlife management actions proposed under Alternative C would be the same as those described for Alternative B.

### **Habitat Restoration**

#### **Otay River Floodplain Restoration**

To better understand the potential effects of proposed restoration on the existing hydrologic and geomorphic characteristics of the Otay River floodplain, preliminary hydrodynamic modeling was conducted for the various restoration options being evaluated for the Otay River floodplain (*Philip Williams & Associates, Ltd. 2003a*). Using a numerical hydrodynamic model, the hydraulic conditions of the lower Otay River, Nestor Creek and South San Diego Bay were evaluated under existing and proposed future conditions. The complete results of this modeling analysis are presented in Appendix I and summarized below.

#### **Flooding Issues**

**Otay River Floodplain Restoration Option 1.** This option involves widening the existing Otay River channel and significantly expanding the area of both tidal and freshwater wetlands (refer to Figure 2-10). The levee around the northern and eastern perimeter of Pond 20A would be removed and a new levee would be constructed along the southern Refuge boundary. This new levee would tie into the existing levee that extends south from the Refuge boundary along the eastern edge of the pond. According to the modeling results, by moving the levee to the southern Refuge boundary, the conveyance capacity of the Otay River increases, the upstream backwater effects are reduced, and the 100-year flood elevations are lowered by more than one foot in several locations (refer to Figure 4-2, Appendix I for predicted changes in flood levels along the Otay River and Nestor Creek channel). Table 4-1 provides a comparison of water surface elevations under existing and alternative conditions for specific points along the Otay River and Nestor Creek.

Within the Nestor Creek drainage (Point E on Figure 3-5), the flood elevations during a 100-year flood would be reduced by approximately two feet. Flood levels within the Otay River would also be lower in all locations between the I-5 bridge and its confluence with Nestor Creek; however, the flood elevation would be expected to increase as a result of restoration where the river passes under the railroad at the northwest corner of Pond 20A (Point D on Figure 3-5). The predicted flood elevation at this location under existing conditions is 13.0 feet NAVD88, while restoration in accordance with Option 1 would raise the flood elevation to 14.0 feet NAVD88. The current elevation of the railroad bridge is approximately 14.3 feet NAVD88; therefore, the predicted increase in the peak water surface elevation at the railroad bridge could adversely affect the structural integrity of the bridge. To avoid the potential for such adverse effects, the Service would coordinate with the City of San Diego during the development of subsequent detailed engineering/restoration plans for the Otay River floodplain to identify appropriate measures for protecting the integrity of the bridge during a flood event.

Also under this restoration option, the portion of Pond 20A to the south of the Refuge would no longer receive spill over from the Otay River under the modeled 100-year conditions. The significant overtopping of the salt pond levees that would occur under existing conditions would continue under this option; however, the length of time during which overtopping would occur would be reduced.



Table 4-1 Comparison of Peak Water Surface Elevations Under 100-Year Flow Conditions					
Location <sup>1</sup>		Existing Conditions	Restoration Option 1	Restoration Option 2	Restoration Option 2 (Modified)
		Peak Water Surface Elevation (ft – NAVD88)			
Otay River	A. Approximately 1000 feet downstream from the I-5 Bridge	18.8	18.0	18.1	18.0
	B. Where the Otay River meets the salt works levee system	18.2	16.8	16.7	16.6
	C. Confluence of the Otay River and Nestor Creek	17.9	15.9	15.8	15.2
	D. Northwestern edge of Pond 20A	13.0	14.0	14.0	15.0
Nestor Creek	E. 2000 feet upstream of the confluence with the Otay River	18.2	16.9	17.8	17.5

<sup>1</sup> See Figure 3-5 for location points.

Otay River Floodplain Restoration Option 2. This option is similar to Option 1 in that it involves an expansion of tidal wetlands and would relocate the Pond 20A levee to the southern Refuge boundary. Unlike Option 1, this option does not include widening of the existing Otay River channel. Instead, the Otay River channel would remain in its current configuration and additional freshwater wetlands would be created to the east of the Saturn Boulevard right-of-way. This option also proposes a larger tidal prism, as the area to be excavated to support coastal salt marsh habitat would be extended farther to the east (refer to Figure 2-11). The hydraulic impacts of this option are similar to those described for Option 1 (refer to Table 4-1). Although Option 2 includes an expanded tidal wetland, this additional excavation would not significantly change the estimated flood elevations from those predicted for Option 1. Specifically, at the location where the Otay River meets the southern most salt pond levees, predicted water levels for Options 1 and 2 differ by less than 2 inches. This is because the water levels upstream of Pond 20A are more heavily influenced by the backwater effects caused by the hydraulic constrictions of the levees than they are by the lowered floodplain. The potential effects to the railroad bridge that are described for Option 1 would also apply to the implementation of this option.

Restoration Option 2 without a Realigned Levee in Pond 20A (Option 2 Modified). A modified version of Restoration Option 2 was also modeled. Under this version, no levee would be constructed along the southern Refuge boundary in Pond 20A. Instead, grading to accommodate restoration in the northern portion of Pond 20A would daylight (match the existing elevation) at the Refuge's southern property line. This modified option also included a proposal for a shallow pilot channel breach from Nestor Creek into Pond 20A (refer to Figure 4-7 in Appendix I). The modeling results for this proposal indicate that flow capacity in Pond 20A would increase significantly, resulting in decreased upstream flooding. However, the decrease in the flood elevation at the confluence of the Otay River

and Nestor Creek (Point E on Figure 4-2) would not be as low as that predicted for Option 1 and only slightly lower than Option 2 (refer to Table 4-1). Additionally, by removing the Pond 20A levee, the railroad bridge at the northwest corner of Pond 20A (Point D on Figure 4-2) would now function as a natural constriction point for the 100-year discharge, increasing the surface water elevation during the 100-year discharge by 2.2 feet to an elevation of 15 feet NAVD88, 0.7 feet higher than the surface of the existing railroad bridge. The implementation of this option would not only subject the railroad bridge to overtopping, it could also expose the bridge to higher discharge, pressure, and scour conditions (*Philip Williams & Associates 2003a*). To avoid any damage to the bridge as a result of implementing this modified restoration option, subsequent detailed engineering/restoration plans would identify the specific bridge and channel modifications needed to improve the structural integrity of the bridge and increase the flow capacity within the channel as it passes under the bridge during a flood event. The incorporation of these modifications into the project scope would reduce potential adverse effects to below a level of significance.

#### **Flow Velocity and Channel Scour**

The three Otay River floodplain restoration options (Option 1, Option 2, and Option 2 Modified) were also evaluated to determine how each might affect flow velocity and channel scour within the Otay River floodplain during a 100-year flood event. Specific details regarding this analysis are presented in Appendix I (*Philip Williams & Associates 2003a*). The analysis, which focuses on flow velocity and channel scour at the railroad bridge (Point D on Figure 3-5), indicates that all three options would produce some increase in discharge velocity and scour at this point. As presented in Table 4-2, the greatest potential increase in discharge velocity would be expected to occur under Otay River Floodplain Restoration Option 2 Modified, while flow velocity would increase by approximately 45 percent over existing conditions under Options 1 or 2. Velocities upstream of the railroad bridge would be slightly lower than existing conditions under Option 1 and would significantly increase under Option 2 and Option 2 Modified. This information combined with estimates of potential changes in localized scour at the railroad bridge, as described below, was used to evaluate the potential effect of restoration on the structural integrity of the bridge.

Table 4-2 Comparison of Velocity Conditions at the Western Railroad Bridge (Point D on Figure 3-5)				
Railroad Bridge Velocity Evaluation (feet/second)	Existing	Option 1	Option 2	Option 2 Modified
Velocity at the bridge	5.8	8.4	8.5	11.2
% change from existing conditions		+44.6%	+46.9%	+92.66%
Velocity upstream of the bridge	4.8	4.4	7.2	8.2
% change from existing conditions		-6.9%	+51.7%	+72.41%

(Source: Philip Williams & Associates 2003a)

Using several methods for computing maximum local scour potential, the average local scour depth at the railroad bridge was computed for each restoration option. The intent of this analysis was to provide a relative comparison of potential scour effects at the railroad

bridge for all options. Based on this analysis, Option 2 and Option 2 Modified would likely result in a  $\pm 20$  percent increase in localized scour at the railroad bridge over existing conditions, while Option 2 would result in about a 10 percent increase over existing conditions.

Increased flow velocities and associated increases in scour potential at the railroad bridge during storm events could adversely affect the structural integrity of the bridge; however, the bridge could already be at risk based on existing conditions within the floodway. Additional analysis would be required to determine if the estimated increase in scour and flow velocity would exceed the current structural design of the bridge or if the bridge would already be at significant risk under existing conditions. In any case, an increase in scour potential of 20 percent or more over existing conditions would represent a potentially significant adverse effect.

Once detailed restoration plans have been completed for the Otay River floodplain, additional hydrodynamic modeling would be conducted to more precisely evaluate the scour potential, flow velocity, and flood elevation in the vicinity of the railroad bridge as a result of the proposed restoration. If the results of this modeling indicate potential adverse affects to the structural integrity of the bridge, the restoration plan would be modified to incorporate measures required to protect the bridge from project-related damage. The anticipated modifications could include reinforcement of lateral and vertical elements, placement of material to reduce channel bed scour, and implementation of measures to mitigate bank erosion. All proposed modifications to the railroad bridge would require coordination with and approval from the Metropolitan Transit Development Board (MTDB), the owner of the railroad bridge, and the City of San Diego, which is processing plans to construct the Bayshore Bikeway on the existing bridge.

### ***Tidal Hydrodynamics***

An evaluation of the expected changes in tidal functions within the Otay River floodplain found that the water level elevation of tidal inundation in the vicinity of both the railroad bridge and the Otay River/Nestor Creek confluence would not be significantly affected by any of the proposed restoration options (*Philip Williams & Associates 2003a*). However, tidal inundation would recede at a slower rate than would occur under existing conditions.

As a result of restoration, the area of tidally influenced habitat would increase by approximately 45 acres over existing conditions under Restoration Option 1 and by approximately 60 acres under Restoration Option 2. Therefore, restoration under either option would substantially increase the tidal prism within the Otay River floodplain. A larger tidal prism would result in increased tidal velocities within the main Otay River channel. Changes in the channel geometry resulting from increased tidal flows are not expected to adversely affect the stability of the railroad bridge or the levees along the river channel; however, additional modeling would be conducted in association with final restoration planning. If potential adverse effects are identified at that time, additional evaluation under NEPA would be implemented.

### ***Water Quality***

Restoration of the Otay River floodplain could result in the following significant adverse effects to water quality if appropriate measures are not implemented to avoid and minimize impacts to downstream water bodies, including the river channel and the bay: 1) increased sedimentation during and immediately following grading; 2) generation and release of pollutants from construction equipment; 3) release of soil contaminants into downstream

areas; 4) release of poor quality groundwater into surface waters as a result of dewatering; and 5) alteration of water circulation patterns that substantially inhibit mixing or promote stagnation.

Grading within the Otay River floodplain could result in temporary increases in turbidity within the river channel, particularly under Restoration Option 1. Sediment transport into the river channel could also occur as a result of channel widening and the disposal of excavated material on the upland areas that abut the river channel. To avoid and minimize the introduction of sediments into the river channel, excavation would be limited during the rainy season and appropriate BMPs, to be developed in association with the final restoration design, would be implemented.

As discussed in Section 3.3.8.3, preliminary site assessments of the Otay River floodplain indicate the presence of pesticides within the soil. Therefore, prior to restoration, a sampling plan would be prepared and implemented to characterize the type and extent of contamination present on the site. Any soils identified as containing excessive concentrations of contaminants would be removed from the site or otherwise appropriately remediated prior to or in association with site excavation. This process would avoid the release of any soluble pollutants into runoff waters as a result of grading.

Although no activities are proposed on the construction staging areas that would affect water quality, there is the potential for petroleum products such as hydraulic fluid or oils to be spilled or leaked from the equipment stored in these areas. To ensure the complete containment of such materials within the staging area, all staging areas would be located in stable upland areas and would be surrounded by a temporary berm. The implementation of BMPs would ensure prompt and appropriate response to any spills.

The restoration design for the Otay River floodplain would be evaluated to ensure that site grading and tidal channel design would not impede water circulation within the restored area. The design would also be evaluated to determine how surface elevations within the restored marsh plain could be affected over time as a result of tidal scour or sedimentation. Any measures necessary to ensure proper tidal mixing and water circulation would be incorporated into final restoration plans.

The proposal to restore tidally influenced coastal salt marsh at the terminus of the Otay River and Nestor Creek would have long-term beneficial effects to the bay in the form of improved water quality. Currently, urban runoff flowing in the Otay River and Nestor Creek empties directly into the bay via the existing river channel. Under any of the restoration options for the Otay River floodplain, these flows would be directed through the restored marsh where marsh vegetation would filter and assimilate many of the organics and nutrients commonly found in urban runoff, thereby improving the quality of the water entering the bay from the Otay River drainage basin.

## **Salt Works Restoration**

### ***Flooding Issues***

Restoring tidal action and modifying the elevations in the various salt ponds, as proposed in Salt Works Restoration Options 1 and 2, would not alter the upstream flood characteristics of the Otay River. In addition, these changes would have no effect on the existing flood flow characteristics within the Otay River channel and the southern levees would continue to be subject to overtopping during a 10-year or greater storm event (*Phillip Williams & Associates 2003a*).

Depending upon the magnitude of the storm, overtopping of the levees could result in the breaching of an outer levee. Larger storms could also breach one or more of the levees within the interior salt ponds, depending upon the peak discharges at the time of overtopping. The primary concern associated with levee overtopping or levee failure relates to potentially significant adverse effects to restored wetlands as a result of excessive scour and/or sedimentation within the restored ponds. As part of final engineering, an analysis would be conducted to develop slope protection measures to protect the levees from failure and the restored wetlands from serious damage. It is anticipated that the slope protection measures would include one or more of the following: biotechnical bank stabilization (the use of living plant material to reinforce soil and stabilize slopes); stone revetment; geotextile-reinforced soil; and/or concrete armor unit revetment. To provide a conservative assessment of the potential impact from such levee protection, it is assumed that all of the levees along Ponds 20, 22, and 48 would be protected with a stone revetment that would extend from the top of the levee to an appropriate depth below the channel bottom. Overtopping would still occur; however, the construction of the revetment along this length of the salt ponds would minimize the potential for future levee failure. Implementing this measure would provide benefits to the restored habitat by reducing the potential for substantial damage during a flood event.

### ***Tidal Hydrodynamics***

The tidal hydrodynamics of the areas within and adjacent to the salt ponds would also change as a result of breaching the levees, restoring tidal action to the ponds, and modifying the bottom elevations of some ponds. Both Salt Works Restoration Options 1 and 2 would restore tidal action to areas of the South Bay that have been separated from the bay for many decades, slightly increasing the overall tidal prism of the bay.

Under current conditions, the water levels in the salt ponds are controlled almost exclusively by the salt works operator. Once the ponds are breached, changes in the water levels within the ponds would be a function of the tides.

Opening Pond 10A to tidal inundation could subject those properties located to the west of 7<sup>th</sup> Street, between the bay and Cherry Avenue in Imperial Beach, to flooding during extremely rare high water level events that correspond to high astronomical tides and low atmospheric pressure tides. These properties appear to have been constructed below the highest high tide mark, which in the bay is 7.71 feet NAVD88. The current elevation at the eastern property line of the Refuge ranges from 6.57 feet NAVD88 at the northeastern corner of Pond 10A to 8.70 feet NAVD88 just south of Cherry Avenue. The elevation of the mean higher high water (MHHW) level is 5.09 feet NAVD88. The mobile home park located immediately to the southeast of Pond 10A, where the elevations range from 5.9 feet NAVD88 to 6.4 feet NAVD88 at the Refuge property line, could experience inundation more frequently, as these properties could be inundated during spring higher high water conditions that occur a few times each year. Over time, the frequency of inundation could increase for both areas, as the tidal datum benchmarks available from NOAA for the latest tidal epoch (1983 – 2002) show an increase in the frequency/elevations of MHHW. Inundation of surrounding properties could also occur during high tides as a result of wind-generated waves within the pond. Subjecting these properties to tidal inundation would represent a significant adverse hydrological effect.

To eliminate the potential for flooding of properties located adjacent to the Refuge boundary during extreme high tides, an earthen berm two or three feet above the existing ground level would be constructed at the edge of the Refuge in those locations where

existing elevations warrant protective measures. The specific design of the berm would be developed during the completion of final restoration plans. This measure would reduce the adverse effects related to tidal inundation to below a level of significance.

Based on preliminary topographic data, there appear to be a few locations within the salt works where the top of the levee is a few inches below the elevation of the highest recorded tide in the bay. Therefore, these low levees could be subject to overtopping during those rare events in which extreme high tides occur. Affected levee sections include levees between Ponds 10 and 10A, between Ponds 12 and 14, and at the northeast end of Pond 13. The levee between Ponds 10 and 10A includes a segment of the Bayshore Bikeway; therefore, a small portion of the bikeway could also be subject to inundation during extreme high tides. In association with the completion of final restoration plans, an evaluation of the need to incorporate measures for minimizing the effects of occasional tidal inundation would be coordinated with the agencies responsible for maintaining the bikeway. Other portions of the bikeway outside the Refuge boundary, particularly a segment located near the Sweetwater flood control channel, are currently subject to infrequent tidal inundation and occasionally flooding. Potential measures that could be incorporated into the restoration design to reduce the occurrence of tidal inundation include raising the elevation of the bikeway in those areas subject to inundation and/or providing slope protection along the affected levees to minimize the potential for erosion during extreme high tide events.

### ***Water Quality***

The potential effects to water quality as a result of restoring tidal wetlands within the Refuge's salt pond complex would include temporary increases in salinity and turbidity within the southern end of the bay.

Salt Works Restoration Option 1. Prior to breaching, the majority of the water within Ponds 10, 10A, and 11 would be drained into the primary ponds on the east side of the Otay River and each pond would be graded (cut and/or filled) to achieve the desired elevations. Excavation in the ponds would occur after the ponds are drained using a dredge, which would require the ponds to be worked when wet, or using conventional dry land equipment. In either case, the ponds would not be breached until the sediments have settled and are no longer suspended in whatever water remains in the ponds. This would minimize the introduction of sediments into the bay during breaching. Draining the ponds prior to breaching would also minimize the effect of introducing water with increased salinities into the bay. As the volume of water remaining in the ponds upon breaching would be minimal, no significant adverse effects to the water quality within the bay are anticipated as a result of breaching. In addition, because the salinity levels in these ponds are relatively low, ranging from 11 to 40 ppt depending upon the time of year, it is unlikely that precipitated salts or higher salinity levels are present in the pond sediments. Therefore, the introduction of tidal action into these ponds would not be expected to release additional salts into the bay. To avoid any unanticipated effects of pond dredging, the pond sediments would be analyzed for salinity content prior to the completion of final restoration plans. If significant accumulation of salts is identified in the sediments, additional measures would be incorporated into the scope of the project to minimize the effects of increased salinities to the bay environment.

Temporary increases in turbidity within the South Bay could occur as a result of the resuspension of sediments within the ponds during initial breaching. The extent to which this increase in turbidity occurs would be dependent upon the character of the sediments

within the ponds prior to breaching. If the character of the sediments consists of fine silts and clay fraction, there is a greater potential for short-term turbidity increases following initial breaching. Coarser sandy material would be less likely to become resuspended. Field studies were conducted in the late 1990s to document the physical environmental factors in the South San Diego Bay. These studies indicate that the overall characteristics of the sediments within the South Bay are relatively uniform and highly suspendable, with the bottom sediments consisting primarily of clay and a thin surface layer of silt (*Merkel & Associates 2000a*). Assuming the sediment characteristics within the ponds are similar to those within the bay, the potential increase in turbidity following breaching would be expected to be similar to the increases in turbidity experienced in the South Bay as a result of normal tidal action and wave action generated by afternoon winds. Suspended sediments may take several hours to several days to settle depending upon the grain size of the sediments (*Merkel & Associates 2000a*). The effects of this resuspension of sediments would be temporary and would not be expected to result in any significant adverse effects to the overall water quality within the bay.

Salt Works Restoration Option 2. Under this option, the western ponds would be breached as described for Option 1 before the remaining primary ponds on the east side of the Otay River (Ponds 12 through 15) are breached. Hydrodynamic and salinity transport modeling was conducted to evaluate the potential effects on salinity levels in the bay of breaching the eastern primary ponds (*Philip Williams & Associates 2003b*). The complete results of this modeling are provided in Appendix I and summarized below.

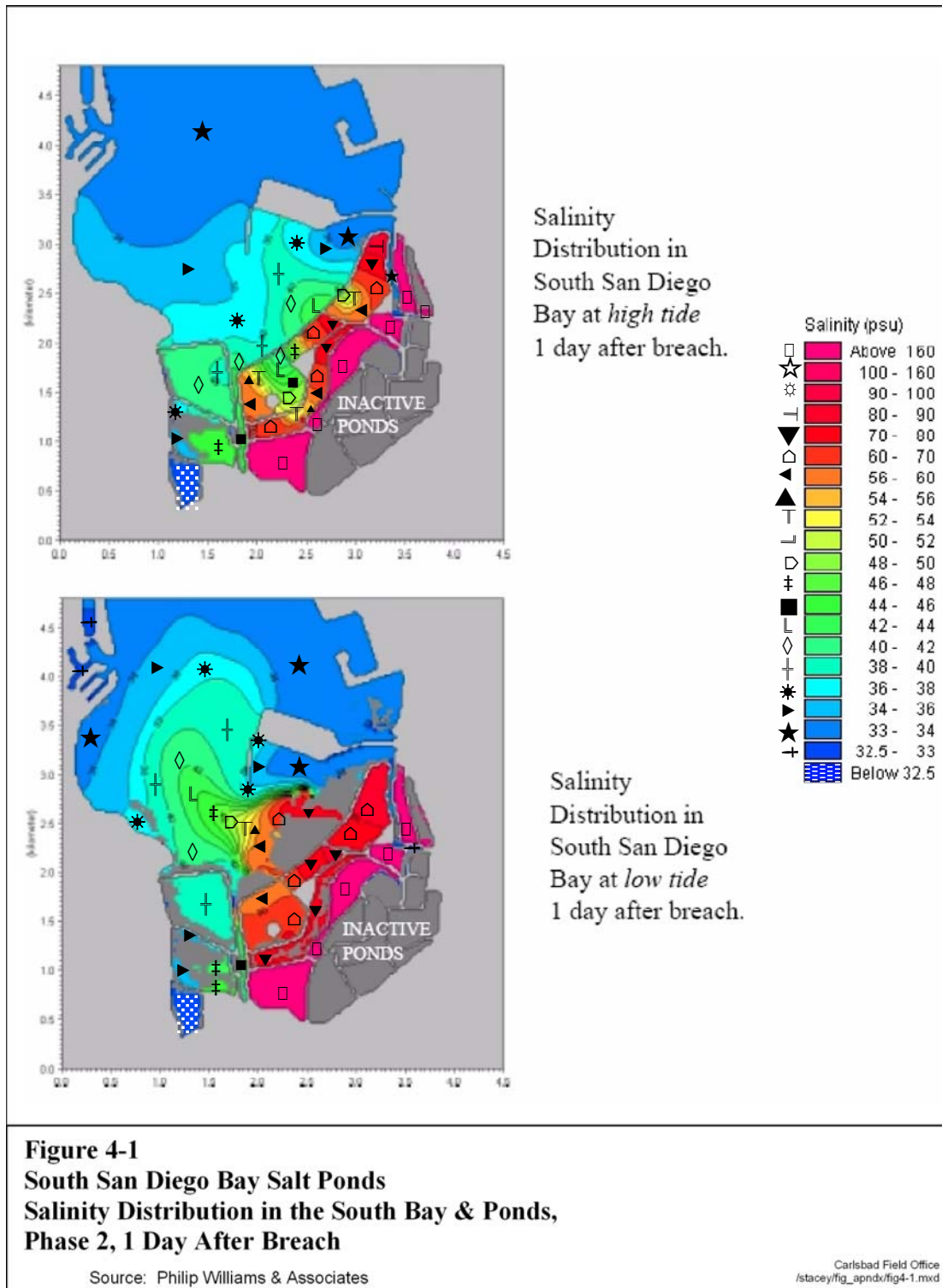
The contour maps in Figures 4-1, 4-2, and 4-3 present the predicted magnitude and extent (spatial and temporal) of increases in bay salinities following the breaching of Ponds 12, 13, 14, and 15. Specifically, the maps illustrate the depth-averaged instantaneous salinity levels in the bay at selected periods for 1 day, 7 days, and 28 days after breaching both at low and high tides. In Figure 4-4, the salinity levels at various locations in San Diego Bay following breaching are plotted as time series. The plots show that salinity levels are highest near the ponds, reaching 50 ppt during the first ebb tide. These salinity levels drop to the mid 40s one day after breaching and are significantly reduced (below 38 ppt) within seven days as indicated in Figures 4-2 and 4-4.

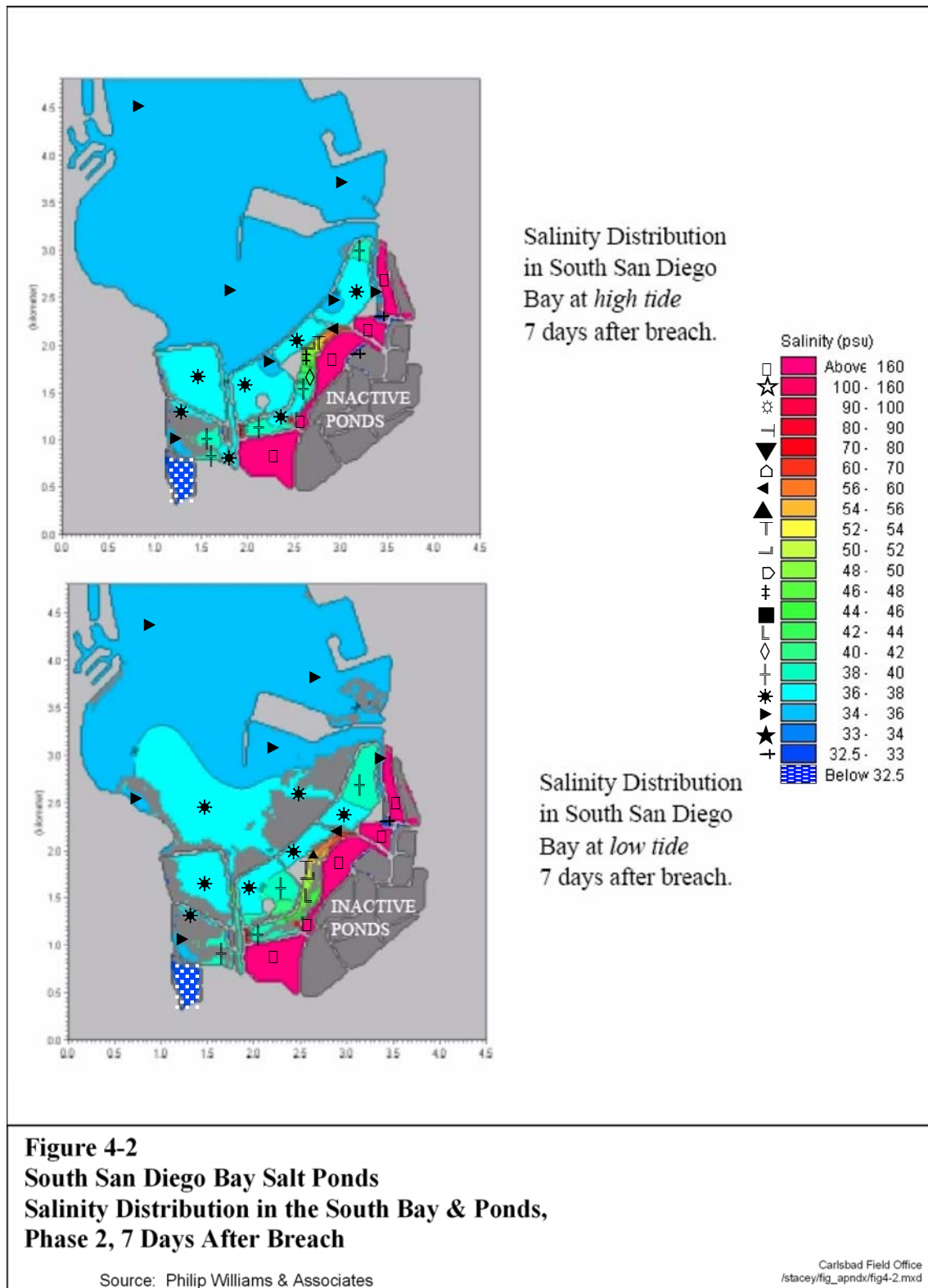
Within the ponds, the salinity levels drop to below 38 ppt or 5 ppt above ambient levels within seven days. After one month, the levels are expected to be reduced to about 35 ppt. Salinity reduction in Pond 13 would be slightly slower because the pond would not be directly breached to the bay, and would therefore rely on tidal action in Pond 12 for flushing. Under this scenario, the salinity level in Pond 13 would be reduced to 38 ppt after 24 days.

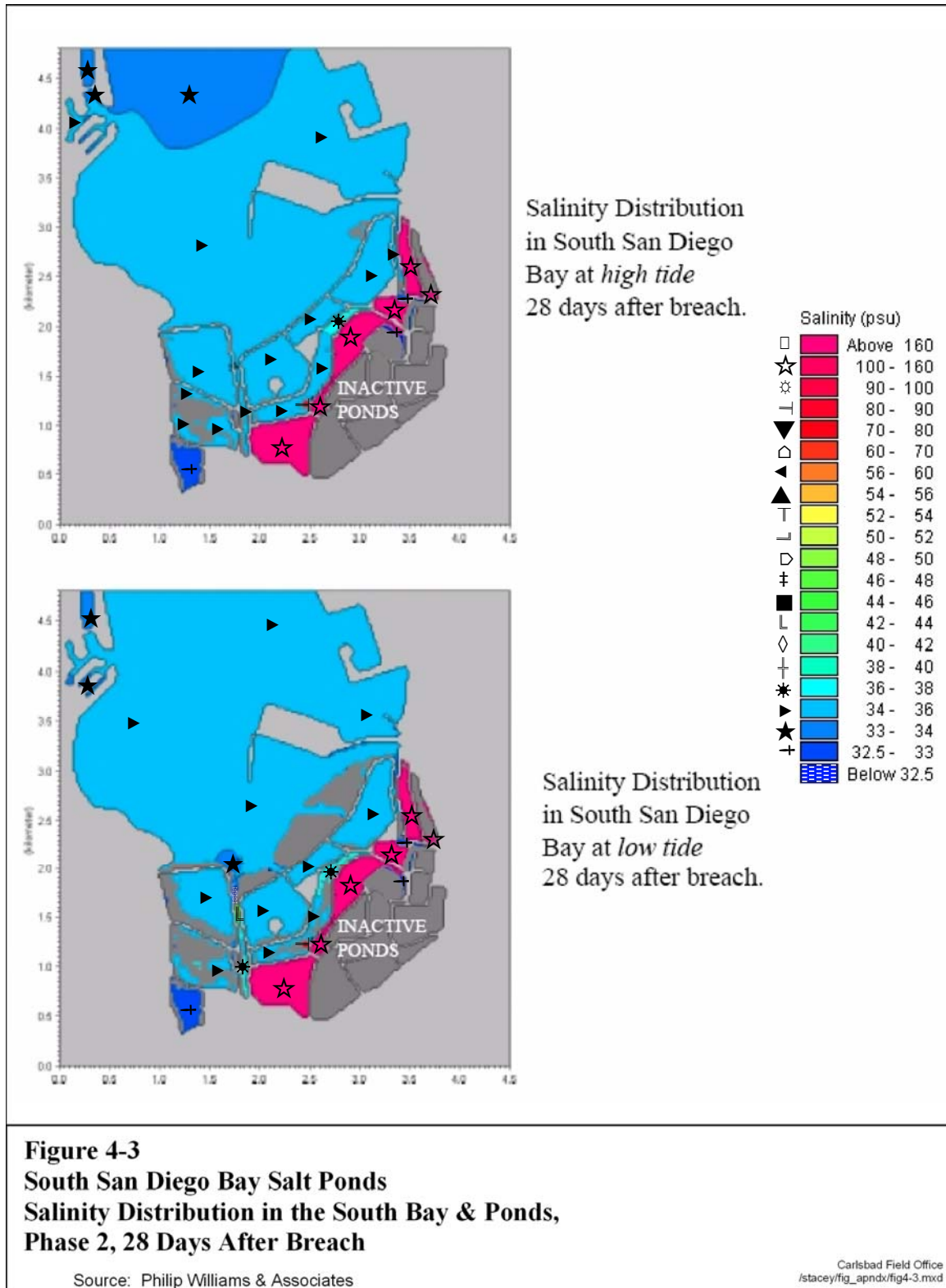
To ensure adequate analysis of the worst-case scenario, the model assumes the ponds are full when breached, however, if the ponds were to be drained farther into the salt works system prior to breaching, the actual effects of pond breaching on bay salinities would be less than predicted by the model. Additionally, the model assumed the ponds would be breached simultaneously. Most likely, pond breaching would be phased over one or two days. This would lessen the initial magnitude of the salinity increases in the bay, although higher than normal salinity levels could persist for a slightly longer, albeit not significant, period of time.

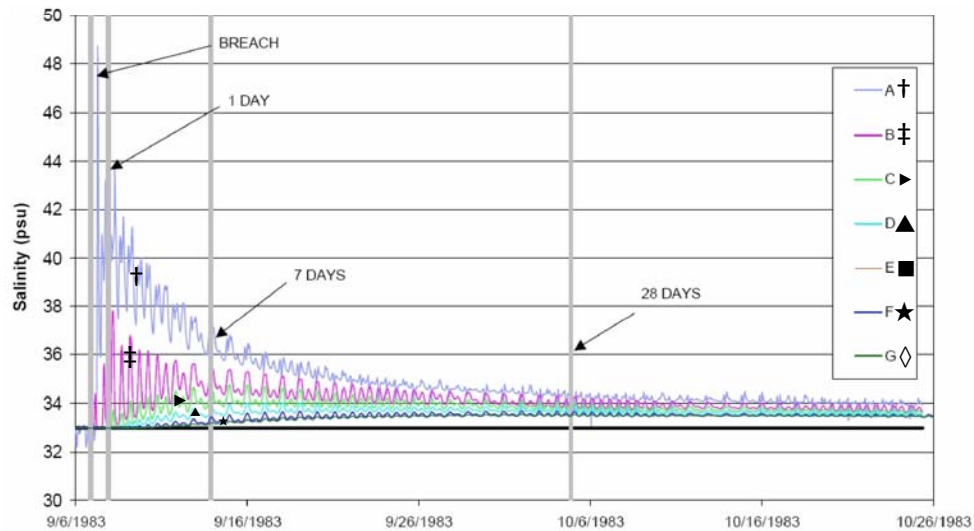
The salt transport model did not take into account the presence of precipitated salts in the ponds, as salinity levels in the sediments are not expected to be significant. Salinity and











**Figure 4-4**  
**South San Diego Bay Salt Ponds**  
**San Diego Bay Salinity Time Series, Phase 2**

Source: Philip Williams & Associates

Carlsbad Field Office  
 /stacey/fig\_spndvfig4-4.mxd

other chemical analysis of the pond sediments has not yet been conducted. Although unlikely, the potential exists for pond sediments to contain elevated salinity levels, metals, organic compounds, and/or excessive nutrients. If present, these elements could be released back into the bay once the ponds are restored to tidal action. Depending upon the type and concentration of such contaminants, if present, pond breaching could adversely affect water quality in the bay. To avoid the potential for such water quality impacts, sediment sampling within the salt ponds would be conducted prior to the completion of final restoration plans. If contaminants are present at levels that warrant remediation, contaminated sediments would be removed or appropriately remediated prior to pond breaching.

### **Public Use**

The minor grading necessary to prepare the northern levee of Pond 11 for public access, as well as the grading associated with the construction of the Otay Valley Regional Trail segment would temporarily expose the soil to water and wind erosion. Such exposure would be minimal and would not represent a significant adverse effect. A potential for some minor long-term erosion problems associated with shoreline fishing access on the northern levee of Pond 11 does exist and would be addressed in a future step-down plan.

#### **4.2.2.3.4 Effects to Air Quality**

##### **Habitat and Wildlife Management**

The effects of implementing the habitat and wildlife management actions proposed under Alternative C would be the same as those described for Alternative B.

##### **Habitat Restoration**

This alternative could be implemented under one of several different scenarios, as described in Section 2.3.2.4. Each scenario would produce temporary increases in combustive and fugitive dust (PM<sub>10</sub>) emissions, but the total emissions would vary depending upon the amount of excavation and export or import of materials required to implement a given restoration scenario. Emission estimates were prepared to determine if any of the restoration scenarios proposed under this alternative would generate construction-related emissions that exceed the Federal conformity thresholds for criteria pollutants, specifically reactive organic gases (ROG), carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), or particulate matter less than 10 microns in diameter (PM<sub>10</sub>) (*Jones & Stokes 2004*).

To generate estimates of exhaust emissions and fugitive dust (PM<sub>10</sub>), the following information was considered: the projected duration of the project; soil import/export estimates (cubic yards of material); estimated truck trips needed to haul material; and estimated of the types and numbers of construction equipment that would be used for individual project phases. Calculations for exhaust emissions also included estimates of off-road construction equipment emissions and emissions from on-road vehicles that would be operated in association with the project, including trucks used to haul material on- and off-site, vendor trips, and worker commute trips. The California Air Resources (ARB) Board's EMFAC2002 model was used to generate estimates for on-road vehicle emission and off-road emission were based on ARB's off-road construction model. A modified version of the road construction emissions model was used to generate estimates of fugitive dust emissions and worker commute trips. The results of these calculations show that the scenarios proposed under this alternative would generate emissions substantially below the Federal conformity thresholds applicable within the San Diego Air Basin (*Jones & Stokes 2004*). Therefore, the requirements of Rule 1501 would not apply, and no significant direct or indirect air quality impacts would be expected. The emissions generated for each scenario are summarized in Appendix H.

##### **Public Use**

The uses proposed under Alternative C would not significantly increase existing visitor and recreational activities in the South Bay; therefore, no significant increases in automobile trips that could lead to air quality impacts would be expected.

#### **4.2.2.3.5 Effects to Noise**

##### **Habitat and Wildlife Management**

The effects of implementing the habitat and wildlife management actions proposed under Alternative C would be the same as those described for Alternative B.

##### **Habitat Restoration**

No residential uses or other sensitive noise receptors currently occur in proximity to the eastern portion of the salt works. However, if development of such uses were to occur on adjacent properties prior to restoration, potentially significant adverse noise impacts could occur. Mitigation measures required to reduce such impacts to below a level of significance

would be determined based on the type of uses affected and the projected noise levels at the property line during construction. Mitigation measures that could be implemented include those measures described in Section 4.2.1.3.5. Specific mitigation measures, if deemed necessary, would be determined at the time that final restoration plans are developed.

Residential development does exist to the south of Ponds 10 and 23 and to the east of Pond 10A. In the vicinity of Pond 10A, the mobile homes along the perimeter of the pond would be located approximately 65 feet from the construction boundary, as would the residences located immediately to the south of the Bayshore Bikeway along the eastern half of Pond 10. The other residences located to the east of Pond 10A would be separated from the construction boundary by a distance of 250 to 700 feet depending upon the width of the existing uplands that separate these homes from the pond. The adopted regulations for the City of Imperial prohibit construction noise in excess of 75 dBA at the property line of residential development. Therefore, based on the typical levels of noise generated by construction equipment (refer to Section 4.2.1.3.5) there is the potential for the proposed construction to exceed approved noise levels for several days while excavation occurs in proximity to these homes. To reduce noise levels to below a level of significance, smaller types of construction equipment could be used that generate lower noise levels or an electric hydraulic dredge could be used that generates noise levels in the range of 72 to 75 dBA at 50 feet. Other measures include limiting the number of hours in a day in which construction activity is occurring in the immediate vicinity of residences or installing temporary noise barriers between the homes and the construction area.

The closest residential uses in the vicinity of the Otay River floodplain include a mobile home park located approximately 700 feet to the south of the Refuge boundary. The other use occurring in proximity to the Refuge is commercial development located at the end of 13<sup>th</sup> Street in Imperial Beach. The separation between the proposed excavation and these uses is great enough that construction generated noise would not exceed adopted noise standards at the property line. No significant adverse noise impacts are therefore anticipated as a result of restoration activities proposed in the Otay River floodplain.

#### **Public Use**

The uses proposed would not generate noise levels perceivable to the surrounding areas; therefore, no significant adverse effects related to noise are anticipated.

### **4.2.2.4 Alternative D – Maximize Habitat Restoration, Moderately Increase Public Use (Preferred Alternative)**

#### **4.2.2.4.1 Effects to Topography/Visual Quality**

##### **Habitat and Wildlife Management**

The effects to site topography and visual quality as a result of implementing the habitat and wildlife management actions included in Alternative D would be the same as those described for Alternative C.

##### **Habitat Restoration**

The analysis of potential effects to site topography and visual quality as a result of restoring the Otay River floodplain that is presented for Alternative C would also be applicable under Alternative D.

The topographic and visual effects associated with restoring the salt ponds under Alternative D would be similar to those described in Alternative C, Salt Works Restoration Option 2. The primary difference would be that under Alternative D, additional ponds would be restored to tidal action. The overall topography within the salt pond complex would remain generally unchanged and the open, unobstructed views across the ponds would not be altered. Restoration of the ponds to tidal action would therefore not result in any significant adverse or beneficial effects related to landform alteration. As described in the visual quality impact discussion for Alternative C, converting the existing open water appearance of a majority of the ponds to intertidal areas with fluctuating water levels could be viewed as adverse by some observers. However, as described further in that section, the Service has determined that the changes in the appearance of the ponds, which would reflect the historic conditions of this area prior to human disturbance, would not constitute a significant adverse effect to visual quality.

Reinforcement of the outer levees along Ponds 20, 22, and 48, as described for Alternative C, Salt Works Restoration Option 2, would also be implemented under this alternative. For evaluation purposes, it is assumed that the levees would be reinforced through the construction of a stone revetment. This revetment would be quite visible from the proposed Bayshore Bikeway and potentially other areas to the south. To reduce the unnatural appearance of the revetment, it would be covered with geotextile-reinforced soil and then vegetated with native plants. The implementation of this measure would reduce the potential for adverse visual effects of the revetment to below a level of significance.

#### **Public Use**

The public uses proposed under this alternative are not expected to result in any adverse effects to visual quality within or adjacent to the Refuge. Between the completion of the draft CCP/EIS and the preparation of the Final CCP/EIS, the proposal to construct an elevated viewing platform at the north end of 13<sup>th</sup> Street in Imperial Beach was deleted and replaced with a proposal to construct an observation area on an existing high point near Florida Street. This change eliminates previously identified potential adverse effects to visual quality related to view obstruction and aesthetics. The specific design of the newly proposed observation area, as well as the other observation areas proposed along the future pedestrian pathway would be further refined during the preparation of project-specific step-down plans.

As described in Alternative C, no significant adverse effects to topography or visual quality would result from the construction of the Otay Valley Regional Trail along the eastern boundary of the Refuge, the continued implementation of the Habitat Heroes environmental education program, or the continuation of recreational fishing and boating in the bay. The other wildlife observation and environmental interpretation proposals included under this alternative would involve minor changes in landform and the construction of some structures, such as decking to accommodate observation areas along the north side of the Bayshore Bikeway. These proposals would not block any views from the adjacent rights-of-way or substantially alter the current character of the area; therefore, no significant adverse impacts related to topography and visual quality are anticipated.



#### **4.2.2.4.2 Effects to Geology, Soils, and Agricultural Resources**

##### **Habitat and Wildlife Management**

The effects to geology, soils, and agricultural resources as a result of implementing the habitat and wildlife management actions included in Alternative D would be the same as those described for Alternative C.

##### **Habitat Restoration**

The effects related to geology and soils as a result of restoring the Otay River floodplain and the salt ponds under this alternative would be the same as those described for Alternative C. Also, as described for Alternative C, the excavation of the Otay River floodplain would irreversibly commit lands identified on the 1998 San Diego County Important Farmlands Map as Prime Farmland (*California Department of Conservation 2000*) to nonagricultural use. However, because it is no longer economically feasible maintain an agricultural operation in this area, the proposed conversion to wetland habitat is not considered a significant adverse impact with respect to agricultural resources.

No adverse effects to agricultural resources would occur as a result of restoring the salt ponds.

##### **Public Use**

No significant adverse effects to geology, soils, and agricultural resources would result from implementing the public uses proposed under Alternative D.

#### **4.2.2.4.3 Effects to Hydrology and Water Quality**

##### **Habitat and Wildlife Management**

The effects to hydrology and water quality of implementing the habitat and wildlife management actions included in Alternative D would be the same as those described for Alternative C.

##### **Habitat Restoration**

The hydraulic changes to the Otay River floodplain and the tidal changes to the salt ponds, particularly in Pond 10A (both described under Alternative C) would also occur under this alternative. The construction of a berm around the southern and eastern edges of Pond 10A, as described in Alternative C, would be implemented to avoid flooding impacts to the surrounding residences during rare episodes of exceptionally high tides.

##### ***Flow Velocity and Channel Scour***

Managing water levels and salinities within some of the ponds in the existing system would require the circulation of bay water through the ponds. Such a process would involve discharging water from the managed water and managed brine ponds back into the bay. It is anticipated that water from the system would be discharged into the existing drainage channel that flows between Ponds 15 and 28. Depending upon the volume and velocity of the water to be discharged, the channel could be subjected to increased scour during periods of water release. Although some scour could occur, this change in the hydrodynamics of the channel is not expected to adversely affect upstream flow characteristics. Additional evaluation of the effects of discharging water from the brine management area into this channel would be conducted during final restoration planning. Additional NEPA review would be required if any new adverse effects are identified.

### ***Levee Breaching***

Under Alternative D, all of the primary ponds, as well as Ponds 23 through 25 and 28 through 30 (the secondary ponds) would be restored to tidal influence. These secondary ponds would be breached once the primary ponds have been breached and the salinity levels in the primary ponds have been reduced to a maximum of 5 ppt above ambient bay levels.

Salinity transport modeling, as described for Alternative C, was also conducted for Alternative D (*Philip Williams & Associates 2003b*). A complete discussion of this modeling effort is presented in Appendix I and summarized below.

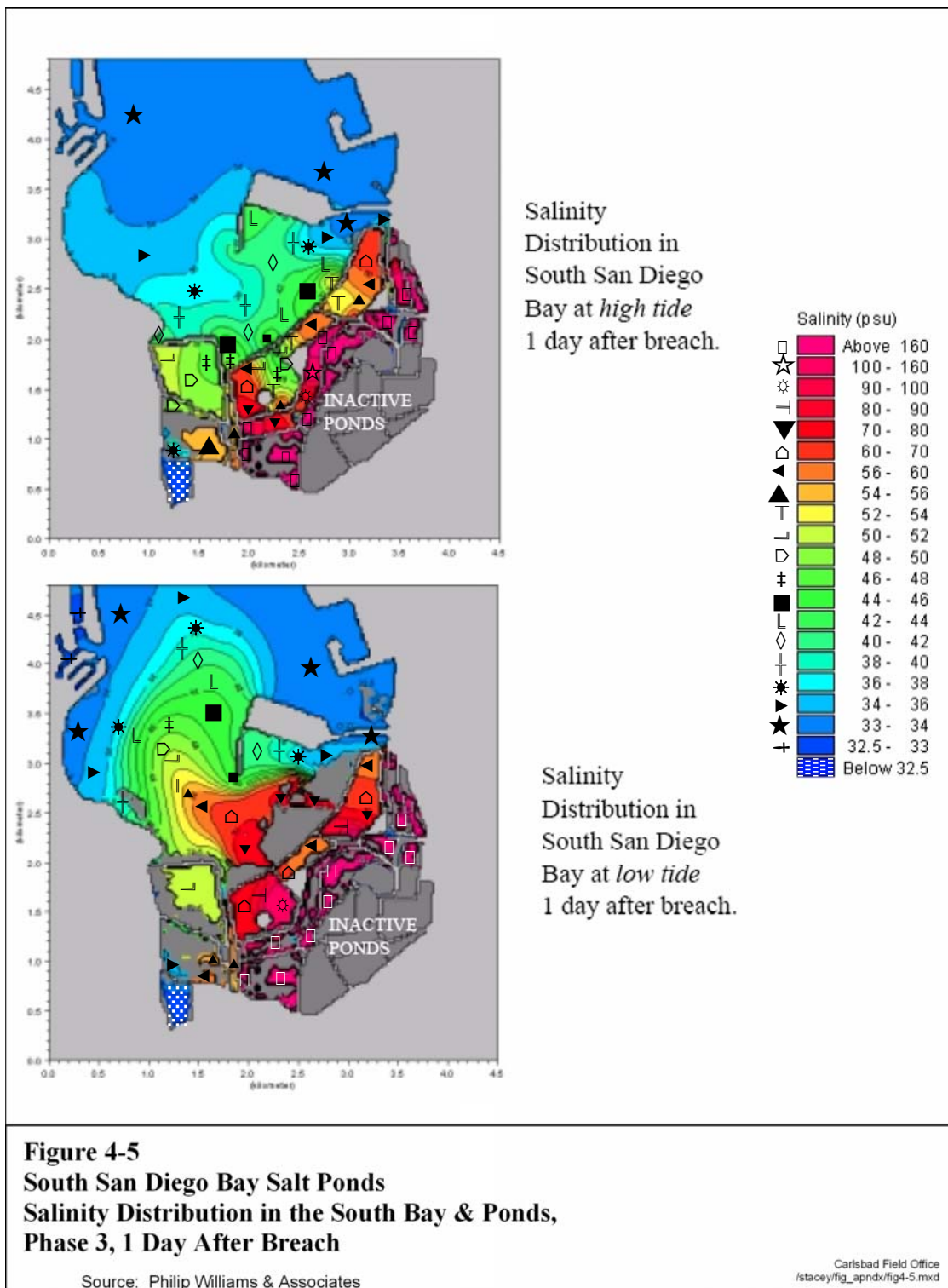
The modeling assumptions were similar to those described in Alternative C except the breaches in the outer levees were assumed to have increased to about 30 feet in width as a result of tidal action. Breaches in the secondary ponds were modeled at a width of about 16 feet. The results of the modeling are illustrated in contour maps at selected periods for one day, seven days, and 28 days after breaching both at low and high tides. These contour maps are provided as Figures 4-5, 4-6, and 4-7 and salinities at various locations in San Diego Bay are plotted as time series in Figure 4-8.

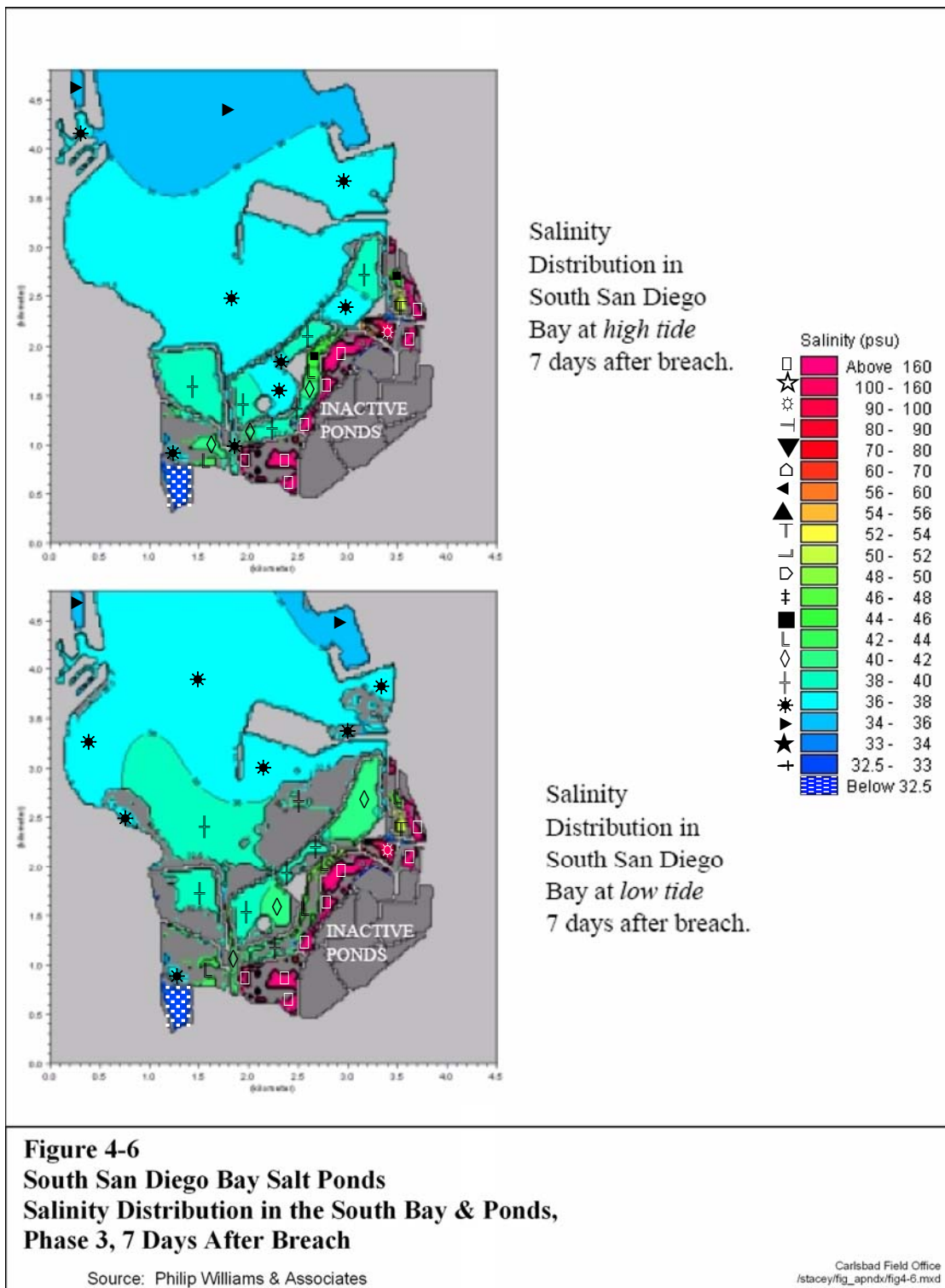
A review of the predicted salinity distribution within the bay indicates that salinities in the vicinity of the ponds peak at 120 ppt during the first ebb tide, then decrease to approximately 60 ppt one day after breaching. The salinities in the breached primary ponds would be even higher and would act to dampen the short-term effects to the bay. Salinities in the immediate vicinity of the ponds would be expected to vary greatly over the tide cycle, with higher salinities observed during the low tide, as hypersaline pond water is discharged into the bay. After seven days, the increase in salinity north of the Chula Vista Wildlife Reserve is less than 5 ppt above ambient levels and numerical results of the model indicate that the potential effects to the bay are negligible after 28 days.

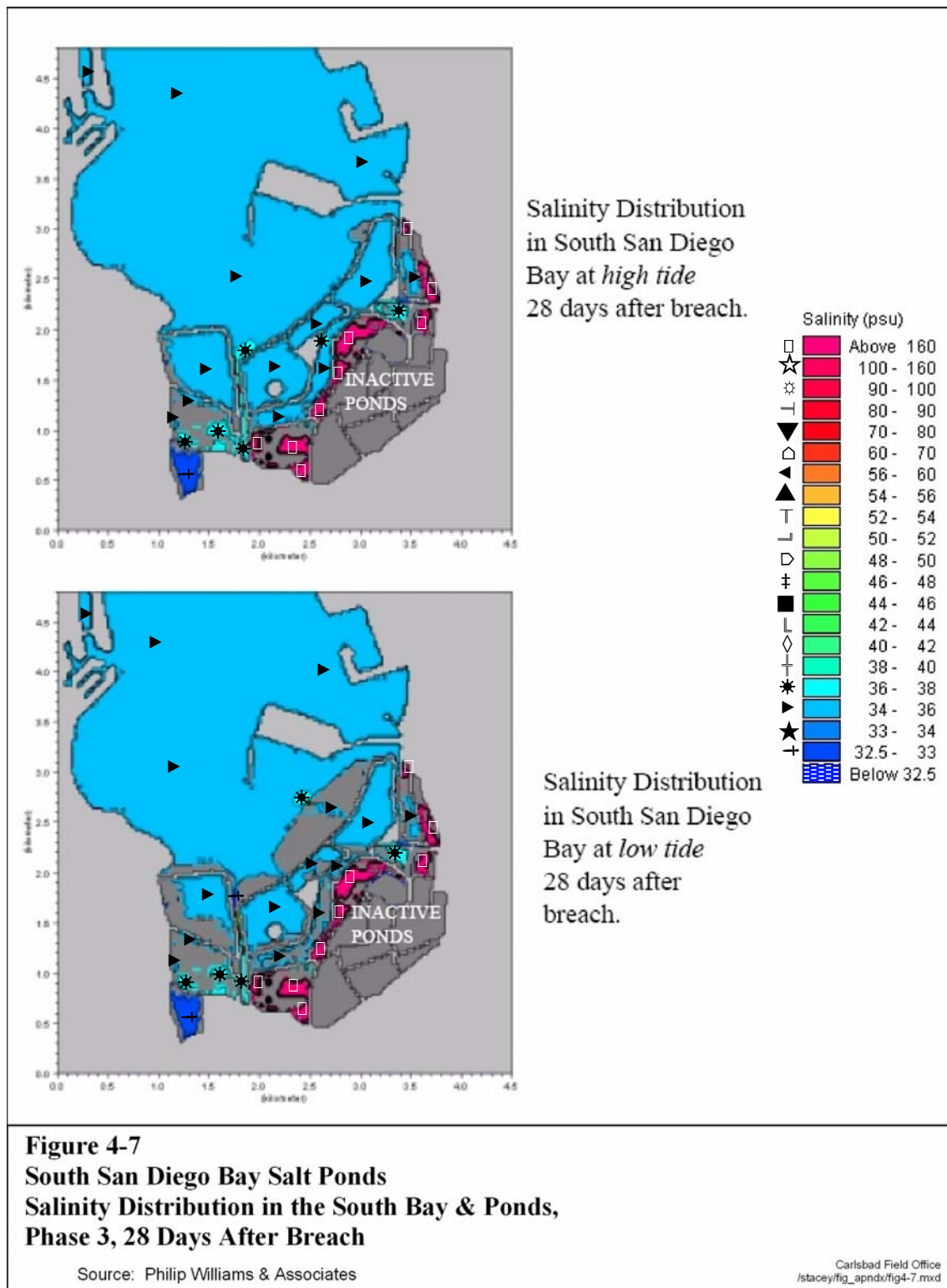
The secondary ponds were modeled assuming no change to the current elevations in the ponds prior to breaching. Based on this assumption, the model indicates that the existing elevations in these ponds are above mean tide level (MTL), with a majority above MHHW. Under these conditions, these ponds would be only partially or rarely tidal. The model indicates that although these ponds would not drain completely due to the topography in the ponds, most of the water would discharge over just six hours, which corresponds to the first ebb tide. Therefore, salinity reduction in these ponds would be very short even under existing topographic conditions.

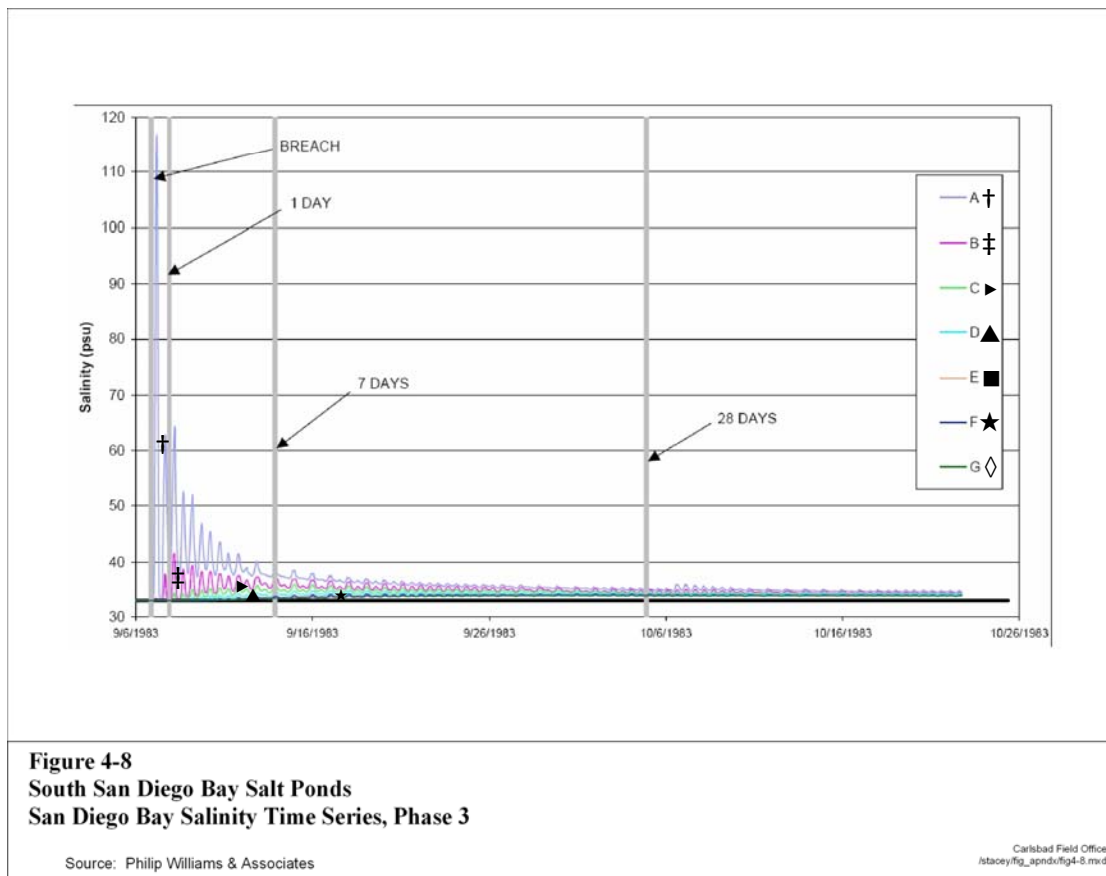
The actual effects of pond breaching on bay salinities could be less than predicted by the model if the secondary ponds are drained farther into the salt works system prior to breaching rather than simply being diluted with bay water upon breaching. The details of levee breaching, including the width and location of the breaches and the phasing of the breaches, would be refined during final restoration design, with the intent of further reducing the effect of breaching on salinity levels within the bay.

The primary salts found in the secondary ponds to be restored to tidal exchange consist of gypsum (calcium sulfate). This substance is relatively inert and is expected to dissolve slowly once subjected to bay water. The presence of a gypsum crust in some of the secondary ponds is not believed to be a water quality issue; however, an analysis of the sediments within the ponds has not yet been conducted. This analysis would be conducted prior to the completion of final restoration plans. The identification of any unanticipated









significant adverse effects related to these gypsum deposits would trigger the requirement for additional NEPA analysis prior to the implementation of any restoration.

Should Scenario 3 of Alternative D be implemented, no grading would occur in any of the ponds prior to breaching and all of the ponds would most likely be full upon breaching. The potential effects to water quality within the bay under this scenario would be the same as those predicted above.

#### ***Discharge from the Managed Water Areas***

Under Alternative D, all commercial salt production would be eliminated on the Refuge and those ponds that are not breached (Ponds 20 through 22, 26, 27, 41 through 43, and 45 through 48) would be managed to support wildlife. The water levels in Ponds 20 through 22, 26, 27, and 48 (the managed ponds) would be managed throughout the year to create loafing, rafting, and nesting areas for a variety of migratory birds. Ponds 41 through 43 and 45 through 47 (the brine complex) would be managed to produce brine invertebrates for foraging birds. The target salinities in these ponds would range from 80 to 120 ppt to ensure optimum conditions for the production of brine flies and brine shrimp.

Bay water would be pumped into the managed ponds to achieve desired water surface elevations. Depending upon the time of year and the amount of evaporation experienced, the salinities in these managed ponds could approach salinities as high as 40 ppt, 7 ppt higher than ambient bay levels. To avoid adverse impacts to the bay's water quality, when the salinity levels in the managed ponds exceed 5 ppt above ambient bay levels, the water from these ponds would be diluted prior to discharge back into the bay or it would be



moved into the brine complex as new bay water is moved into the managed ponds. Similarly, discharge from the brine complex would be diluted to within 5 ppt of ambient bay levels prior to releasing the water back into the bay.

The specific design and operation of the managed water area, including the managed ponds and the brine complex, would be refined during final restoration planning. The feasibility of these systems, particularly the brine complex component, was evaluated as part of the current planning process. The details of this evaluation, which was conducted by Philip Williams & Associates (2003b), are presented in Appendix J and summarized below.

The basic components required to implement brine management include a source of seawater inflow to the brine ponds; a source of water, referred to as make-up water, to dilute the brine pond outflow; a mixing basin to combine the brine outflow and make-up water; and a discharge route to the bay. This system assumes that inflow to the brine ponds would be supplied from the managed ponds, as described above. Several ponds within the managed water area would be suitable as mixing basins. These include Ponds 41 and 48, which are located immediately adjacent to the proposed brine ponds. Pond 41 is depicted as the mixing basin in Figure 2-16. The make-up water to be provided to the mixing basin is assumed to come from the bay. This could be supplied from any of the tidal ponds, preferably as far from the eventual brine discharge point as possible. Salinities in the mixing basin would be maintained at no more than 5 ppt above ambient bay levels. The diluted effluent could then be discharged into a drainage canal located to the west of Ponds 41 and 30. From here, the diluted water would be discharged into the bay through the existing drainage channel located between Ponds 15 and 28. If Pond 48 is used as the mixing basin, some grading and levee construction would be required to connect Pond 48 with the canal. Under this scenario, water would be circulated through the managed water ponds and then moved into the brine complex ponds. This system was modeled to determine feasibility, and in particular to estimate how much make-up water would be required to maintain the mixing basin (Pond 41) at 5 ppt above ambient levels. According to the model, the flow rate of make-up water into the mixing basin would peak at about 1,330 gallons per minute (gpm); approximately 900 gpm (68% of the total) would be needed to dilute the brine effluent to discharge levels, and the remaining 420 gpm (32% of the total) would be required to offset the effects of evaporation within the mixing basin. These results suggest that the required pumping rates are feasible, assuming continuous pumping. Discharges to the bay would range between 330 and 1,330 gpm.

Pumping rates could be reduced through the process of flash mixing. This process would involve rapidly diluting the brine outflow in a small basin or canal prior to discharge to the bay. Flash mixing requires smaller flow rates since the effects of evaporation on a small pond surface area are negligible and would reduce peak flows to about 800 gpm (from 1,330 gpm). The canal west of Ponds 30 and 41 would be a potential location for flash mixing.

The results of the modeling analysis suggest that management for brine habitat is feasible from a physical process perspective; however, the model includes several simplifying assumptions for the purpose of preliminary feasibility assessment. To implement the brine management component, these assumptions would be assessed in greater detail in association with the development of final restoration plans. To avoid significant adverse effects to bay water quality, any discharge from this operation would be maintained at or below salinity levels of 5 ppt above ambient bay levels at the time of discharge.



### **Public Use**

The observation areas and interpretive elements proposed along the southern edge of the Refuge would occur in an area overlain by soils characterized as Huerhuero urban land complex (*USDA 1973*). These soils, which occur along the southern bank of the Otay River, are easily eroded if disturbed. To avoid or minimize erosion and/or sedimentation into the river, the following measures would be incorporated into the design of these facilities: all observation areas and interpretive elements would be sited to maintain a minimum of 25 foot buffer from the edge of the slope; appropriate fencing would be installed along the northern perimeter of viewing areas; all observation and interpretive areas would be graded to direct runoff toward the street and away from adjacent slopes; and materials used to surface these area would be porous and non-erosive. These measures, which would reduce adverse effects to below a level of significance, would be further refined during subsequent step-down planning.

#### **4.2.2.4.4 Effects to Air Quality**

##### **Habitat and Wildlife Management**

The effects to air quality as a result of implementing the habitat and wildlife management actions included in Alternative D would be the same as those described for Alternative C.

##### **Habitat Restoration**

This alternative could be implemented under one of several different scenarios, as described in Chapter 2. Each scenario would produce temporary increases in combustive and fugitive dust (PM<sub>10</sub>) emissions, but the total emissions would vary depending upon the amount of excavation and export or import of materials required to implement a given restoration scenario. ROG, CO, NO<sub>x</sub>, and PM<sub>10</sub> emission estimates for each scenario are presented in Appendix H (refer to air quality discussion in Section 3.3.7 for more information related to these emission estimates). The estimated emission levels presented in Appendix H show that implementing any of the scenarios presented in this alternative would generate emissions substantially below the federal conformity thresholds applicable within the San Diego Air Basin. Consequently, a conformity determination would not be required and no significant adverse effects to regional air quality would result from restoration under this alternative.

### **Public Use**

New and expanded wildlife-dependent recreational uses would be provided on this Refuge Unit under Alternative D. These expanded opportunities for public use would result in some increases in car and bus trips to and from the Refuge Unit. The majority of these trips would occur during be off-peak traffic hours; therefore, they would not contribute directly or cumulatively to traffic congestion or to the air quality impacts associated with increased traffic congestion. Installation of the proposed public amenities would result in the generation of air emissions during construction, however, the duration of construction would be short and the number of motorized construction vehicles needed to accomplish the work would be minimal. Therefore, air emission from these activities would not meet or exceed the standards established in Rule 1501 of the APCD Rules and Regulations. No significant adverse effects related to air quality are therefore anticipated.

#### **4.2.2.4.5 Effects to Noise**

##### **Habitat and Wildlife Management**

The effects to noise as a result of implementing the habitat and wildlife management actions included in Alternative D would be the same as those described for Alternative C.

### **Habitat Restoration**

Although this alternative would involve more grading than that proposed under Alternative C, the additional grading would occur far from any sensitive noise receptors. Therefore, the effects of this alternative on ambient noise levels would be similar to those described for Alternative C. The mitigation measures described in Alternative C to reduce excessive noise levels at the Refuge boundary in the vicinity of Pond 10 and 10A would also be implemented under this alternative.

Unlike Alternative C, this alternative would include the use of pumps to move water within the managed water area and to dilute water exiting the managed brine area. The potential for noise impacts from these pumps would depend upon the size and placement of the pumps within the Refuge. To avoid impacts to adjacent uses, pumps would be located a sufficient distance from the Refuge boundary to avoid excessive noise levels at the property line. If it is determined that a pump must be located near an adjacent noise sensitive use, measures such as housing the pump in a noise reducing structure, would be taken to ensure that the noise level at the property line is at or below the approved noise level (per the local jurisdiction's noise ordinance) for the adjacent use.

### **Public Use**

No adverse effects related to noise would result from implementing the various public uses proposed under this alternative.

## **4.3 Effects to Habitat and Vegetation Resources**

The effects to Refuge habitats and vegetation as a result of implementing the various alternatives are described below. Potential impacts to these resources are characterized by evaluating direct, indirect, and cumulative effects. Direct impacts would involve the removal of vegetation as a result of ground-disturbing actions, while indirect impacts would involve changes to habitat or vegetation that are incidental to the implementation of an action. Cumulative impacts to habitat and vegetation resources, described in Section 4.9.2.2, would result when the incremental impact of an action is added to other, closely related past, present, or reasonably foreseeable future actions.

An adverse effect to habitat or vegetation resources would be considered significant if:

- A substantial portion of native habitat would be removed or otherwise modified to accommodate a proposed action.
- An action would result in the direct mortality or habitat loss, lowered reproductive success, or habitat fragmentation of a sensitive or narrow endemic plant species.
- A significant cumulative effect would occur if the loss (adverse effect) or restoration (beneficial effect) of native habitat or a sensitive or narrow endemic plant species as a result of the proposed action is minor but, when considered in light of other similar losses or gains within the region, would be considerable.

A significant beneficial impact would occur if a substantial area of native habitat (an increase of more than 30 percent) is restored or the reproductive success of a sensitive or narrow endemic plant species is substantially increased as a result of improved habitat quality.

### 4.3.1 Sweetwater Marsh Unit

**Habitat Planning Context.** The management proposals included in the alternatives for the Sweetwater Marsh Unit would all contribute in some way to the implementation of the actions and/or recommendations included in the various recovery, ecosystem planning, wildlife action, and bird conservation plans described in Section 3.4.1.3. The action alternatives (Alternatives B and C), which include proposals for habitat enhancement and restoration, would provide a greater contribution than would Alternative A.

The potential effects to habitats, including subtidal, intertidal, coastal salt marsh, and upland habitats, and to native vegetation are described below for each of the three alternatives for the Sweetwater Marsh Unit.

#### 4.3.1.1 Alternative A – No Action

##### 4.3.1.1.1 Effects to Subtidal, Intertidal, Coastal Salt Marsh, and Upland Habitats

##### Habitat and Wildlife Management

Under Alternative A, no changes to the habitat management activities currently being conducted on this Refuge Unit would occur. As such, no new significant adverse or beneficial effects to the existing habitats or vegetation on the Refuge would result from the implementation of this alternative. Implementation of the Refuge's Integrated Pest Management Plan, specifically the use of herbicides to control invasive, non-native plants, could adversely impact non-target plants due to pesticide drift, if appropriate application techniques are not employed. However, the potential for adverse effects is expected to be minimal because of the small quantities of herbicide used and the precautionary measures taken during application. Hand weeding, rather than spraying, would be conducted in sensitive habitat areas, such as areas dominated by native salt marsh habitat or in areas that support salt marsh bird's beak and other sensitive plant species. If spraying is proposed in proximity to sensitive habitat areas, the area to be sprayed would first be surveyed for sensitive species and areas to be avoided during spraying would be flagged or otherwise delineated to ensure avoidance of these areas. Hand weeding and limited herbicide spraying would also provide minor benefits to habitat areas by providing opportunities for increased native plant cover. Removal of litter and other debris from the marsh complex could also result in temporary impacts related to trampling of marsh vegetation; however, such impacts would be short-lived and minor and would be offset by the benefits of removing these materials from the marsh. Although no new significant benefits to Refuge resources would be realized under this alternative, the existing habitats would derive some benefit from the control of invasive species; enforcement of Refuge regulations, particularly as they relate to public access; and habitat monitoring.

Restoration of the mitigation leasehold overlays could occur under this alternative, but such restoration is not assured, since it would only occur at the discretion of the leaseholder. The leaseholder or a designated third party would evaluate the environmental consequences of implementing restoration plans for the mitigation leasehold overlays at such time as specific restoration plans are proposed. As a result, no analysis of potential impacts for restoration under the current MOU is provided.

##### Public Use

Public access would continue to be restricted to Gunpowder Point, providing benefits to the sensitive habitats and vegetation on the Refuge Unit. Regulatory signage is often not an effective deterrent and unauthorized entrance of people and their dogs occurs in the closed

portions of the Refuge Unit. This activity, which can result in habitat and wildlife disturbance, would be expected to continue under this alternative. The public uses currently permitted in this area (i.e. wildlife observation and photography and environmental education and interpretation) would continue. Therefore, the potential for impacts related to human intrusion into native habitats and trampling of native vegetation would also continue. Although such impacts are minimal, they do occur, particularly in areas on Gunpowder Point where trails end at the edge of salt marsh habitat or lead visitors to the edge of the intertidal mudflats that border the Refuge to the west and south. Post and cable fencing has been installed along the trails, as well as across the ends of the trails, to discourage visitors from entering the adjacent sensitive habitats. Unfortunately, a small number of visitors choose to ignore signage and fencing, which could ultimately lead to some degradation of the adjacent habitats and/or damage to rare or endangered plants, such as salt marsh bird's beak.

#### **4.3.1.2 Alternative B – Habitat Enhancement/Interpretation**

##### **4.3.1.2.1 Effects to Subtidal, Intertidal, Coastal Salt Marsh, and Upland Habitats Habitat and Wildlife Management**

Expansion of the current habitat management activities to include a more aggressive invasive plant species control program and the development of a public outreach and education program would provide moderate benefits to the habitat and native vegetation on the Refuge Unit. As described above, although impacts to non-target plants could occur as a result of herbicide application, these impacts are considered minor and the benefits of invasive plant control would be greater. Controlling invasive species within the high marsh and upland transition areas would reduce competition between native plants and the more aggressive weedy, non-native plants. Where native and non-native plants are occurring together, hand weeding or specialized techniques for applying herbicide to nonnative plants would be conducted. As more native plants become established within the upland transition areas, these and other native vegetation in the marsh would benefit from an increased presence of native pollinators, which are essential to the reproduction of several sensitive marsh plant species found on this Refuge Unit.

The public outreach and education program is intended to reduce unauthorized activities on Refuge lands. Sensitive marsh habitat would benefit from a reduction in the incidence of human and dog intrusion into the marsh and the reduction in other unauthorized activities, such as illegal dumping and the release of unwanted pets onto the Refuge Unit.

##### **Habitat Enhancement**

This alternative proposes a number of enhancement actions intended to improve tidal circulation within the marsh complex. The implementation of these enhancements could result in the removal of some native vegetation in order to improve conditions for the remaining native habitats on the Refuge. Specifically, this alternative proposes the removal of the abandoned roadbed that traverses a portion of the Sweetwater Marsh and the installation of an additional culvert under the current access road to Gunpowder Point (refer to Figure 2-3). These actions would result in the removal of any vegetation present on the abandoned roadbed and on the slopes of the access road at the site of the new culvert. The vegetation to be affected would include a combination of non-native invasive plants and some native upland/upland transition species. Approximately 7,500 square feet of vegetated and unvegetated area would be impacted at the abandoned roadbed site and less than 3,000 square feet of vegetated slopes would be impacted at the culvert site.

Following implementation of the proposed enhancements the impacted areas would be restored to salt marsh habitat. These two enhancement proposals would improve the tidal circulation within the eastern portion of the marsh, benefiting more than 20 acres of tidal salt marsh. Improved circulation in this portion of the marsh is expected to result in healthier stands of cordgrass which would provide higher quality nesting habitat for the light-footed clapper rail.

Temporary impacts to surrounding coastal salt marsh vegetation could occur during project implementation due to construction equipment disturbance and/or trampling by construction crews. To minimize construction related impacts, sensitive habitat areas in proximity to the construction site would be flagged and/or fenced; construction access routes would be selected that avoid or substantially reduce the need for intrusion into the marsh; and small scale, low impact construction equipment would be used whenever possible. Although some native vegetation would be adversely affected, in all cases the losses would be offset by the improved habitat quality within the marsh as a result of increased tidal circulation. For the most part, nonnative or previously revegetated native upland areas would be replaced with new native habitat, primarily low- and mid-marsh habitat. Any adverse effects resulting from the proposed habitat enhancements would therefore be considered well below a level of significance.

Lowering the levee near the southern tip of Sweetwater Marsh, if deemed feasible, would impact a small area of non-native ornamental and invasive weedy vegetation. Although a few native plants could be lost, the overall adverse effects to the Refuge's native habitat would be minimal and long-term benefits (as described above) to the Refuge's salt marsh habitat from improved tidal circulation would more than offset any adverse effects.

Nesting enhancements proposed for the D Street Fill would occur in proximity to several native coastal dune plant species, including Nuttall's lotus and coast woolly heads. Patches of native salt grass also occur throughout the nesting area. Annual preparation of the site for tern and plover nesting could result in inadvertent damage to some of this vegetation. To reduce these potential impacts, areas supporting a significant population of sensitive plants and/or significant patches of salt grass would be flagged or fenced prior to annual nest site preparation. Refuge staff would review these locations with contractors prior to commencing enhancement activities and periodic monitoring by Refuge staff would occur.

#### **Public Use**

Effects to Refuge habitats as a result of implementing the public uses proposed under this alternative would be essentially the same as described under Alternative A. The installation of new interpretive elements in the vicinity of Paradise Marsh and F&G Street Marsh would occur within the adjacent public right-of-way and would not adversely affect any native habitats. The interpretive messages provided would provide minor benefits to the adjacent coastal habitats as many members of the public would gain a better understanding of the need to protect the native vegetation within these Refuge areas.

#### **4.3.1.3 Alternative C – Habitat Restoration/Enhance Public Use (Preferred Alternative)**

##### **4.3.1.3.1 Effects to Subtidal, Intertidal, Coastal Salt Marsh, and Upland Habitats Habitat and Wildlife Management**

The effects of implementing invasive plant species control in upland transition areas around the marsh complex, as well as on Gunpowder Point, are the same as those

addressed under Alternatives A and B. Refuge participation in watershed management planning and local land use planning could benefit Refuge habitats and vegetation if this planning leads to improvements in the quality of the water entering the Refuge from upstream sources.

### **Habitat Restoration**

Restoration of Gunpowder Point would result in the conversion of approximately 25 acres of disturbed uplands, characterized by a mix of native and non-native shrubby vegetation, to coastal sage scrub and maritime succulent scrub habitat. To restore this area, the nonnative vegetation would be removed, while the scattering of healthy native shrubs that have recolonized Gunpowder Point over the past 20 years would be retained. In those areas where nonnative plants are removed, the site would be revegetated using a combination of native container plants and seeds. In areas where buried plastics are present, it may be necessary to remove all of the vegetation, properly dispose of the plastics, and then revegetate the area with native species. The adverse effects of removing native vegetation would be offset by the restoration of the impacted areas to native habitat.

To avoid any adverse effects to the remnant patches of maritime succulent scrub on Gunpowder Point, these areas would be mapped and flagged and/or fenced prior to restoration in the surrounding areas. Refuge staff would inform any contractors or Refuge crews of the requirements to protect these areas during restoration activities.

Restoration at the D Street Fill under this alternative would involve the conversion of approximately 13 acres of disturbed upland habitat to subtidal, intertidal, and coastal salt marsh habitat. A number of coastal dune plants have colonized this area, including Nuttall's lotus and coast woolly heads, both of which are species of concern. Preliminary restoration plans under this alternative include retaining a strip of upland area along the eastern edge of the fill, where these species have been previously identified. The preservation of this area is intended to minimize adverse effects to these sensitive plant species. Restoration by the Service under this alternative would not occur until after 2010; therefore, the locations and population size of these species may change. An accurate evaluation of potential impacts cannot be made until final restoration plans for this area are developed and a survey of the existing vegetation identifying the location and population size of all sensitive species is completed. Future restoration of this area may require subsequent NEPA analysis to address these site-specific issues. An analysis of the potential effects to nesting least terns and snowy plovers as a result of converting this area back to intertidal habitat is provided in Section 4.5.1.3.

The alternative also proposes to restore native habitat in the F&G Street Marsh by removing undocumented fill material from the northern portion of the marsh. This action would replace approximately six acres of weedy, non-native vegetation with six acres of native salt marsh habitat. This would represent more than a 30 percent increase in native salt marsh habitat within the F&G Street Marsh, and would therefore be considered a significant beneficial effect. Temporary impacts to salt marsh habitat could occur during excavation, particularly in those areas that abut the proposed restoration site. These disturbances to existing native vegetation would be minimized by flagging sensitive habitat areas and providing silt barriers during excavation. Refuge staff would also monitor construction activities to ensure compliance with grading restrictions. Any minor unavoidable impacts would be offset by the beneficial effects associated with the overall restoration of the marsh. Such beneficial effects include increased tidal circulation and

improved water quality, which in turn would lead to improvements in the health of the plants and generally higher biological productivity within the marsh.

#### **Public Use**

The proposal to redesign the existing trail system on Gunpowder Point would benefit Refuge habitats and native vegetation as the new trail system would be designed to reduce the potential for inappropriate off-trail activity. Specifically, trails that currently dead-end at the edge of sensitive habitats, enticing some visitors to travel beyond the trail, would be replaced with loop trails that provide visitors with views of the adjacent habitats, while encouraging them to continue along the path. A revised interpretative plan would also provide opportunities for informing visitors of the importance of the habitats that occur beyond the trail and the need to reduce human disturbance in these areas.

Environmental education programs conducted on this Refuge Unit are not expected to result in any significant adverse effects to native vegetation; however, the program could result in significant long-term benefits to this resource as the public becomes better informed about the sensitivity of the habitats that occur on the Refuge Unit. Some of the refuge-related benefits of environmental education include creating new partnerships with members of the surrounding community, changing public behavior to reduce direct and indirect impacts to wildlife, habitat, and water quality, and increasing the public's awareness of the need to protect sensitive species on site and throughout their range.

### **4.3.2 South San Diego Bay Unit**

**Habitat Planning Context.** The management proposals included in the alternatives for the South San Diego Bay Unit would all contribute in some way to the implementation of the actions and/or recommendations included in the various recovery, ecosystem planning, wildlife action, and bird conservation plans described in Section 3.4.1.3. The action alternatives, particularly Alternatives C and D, would address the recommendations for coastal wetland restoration that are included in a number of these plans.

The potential effects to open water, subtidal, intertidal, coastal salt marsh, freshwater wetland, and upland habitats of implementing the alternatives described for the South San Diego Bay Unit are presented below.

#### **4.3.2.1 Alternative A – No Action**

##### **4.3.2.1.1 Effects to Open Water, Subtidal, Intertidal, Coastal Salt Marsh, Freshwater Wetland, and Upland Habitats**

##### **Habitat and Wildlife Management**

The potential for adverse effects to Refuge habitats and native vegetation from the continuation of current habitat management activities would be minimal. The control of invasive plant species would have effects similar to those addressed in Alternative A for the Sweetwater Marsh Unit and mowing of non-native annual vegetation in the Otay River floodplain would provide minor benefits to native vegetation by reducing biomass and weed seeds in disturbed areas.

Implementation of the Cooperative Agreement requirement to provide additional foraging habitat within the salt pond complex for California least terns would occur after completion of step-down planning and project-level environmental analysis. The short term effects of discharging high salinity waters into the bay and/or Palomar drainage channel would be



analyzed, as would the effects to adjacent habitats of restoring tidal action to one or a portion of the salt ponds, possibly Pond 28 or 29. The benefits of this action (i.e., minor increases in the total acreage of subtidal and intertidal habitats within the Refuge) would also be considered during the step-down planning process.

Because the ponds do not support any native subtidal or intertidal habitat, the installation of additional pelican platforms within the ponds would not result in any adverse effects to native habitats or vegetation.

#### **Public Use**

The continuation of the public uses that currently occur on this Refuge Unit (boating, fishing, and wildlife observation and photography) could result in minor adverse effects to the native habitats. Specifically, adverse effects to open water habitat from the continuation of recreational boating and fishing could occur if motorized boats enter the shallow areas of the South Bay and create damage to the existing eelgrass beds. Another potential impact related to boating and fishing relates to inappropriate landing of motorized and non-motorized boats along the edge of the outer levees of the salt works where disturbance and trampling of intertidal mudflats and salt marsh vegetation could occur. Such impacts would be avoided or minimized by adherence to the “no wake” speed limit established for much of the South Bay and compliance with “closed area” signage within the Refuge.

No adverse effects to Refuge habitats are anticipated as result of continuing to conduct guided nature tours of the salt works outside of the nesting season.

#### **Solar Salt Production**

Under current management practices, the solar salt operation maintains the ponds within the system at varying salinities levels. For the most part, the salinity levels in the ponds, particularly in the secondary and crystallizer ponds, are well in excess of average bay salinities. These salinity levels inhibit the growth of native wetland vegetation both within the ponds and on the interior levees of the ponds. The other levees, which abut the bay, do however support patches of high marsh vegetation, including pickleweed, glasswort, alkali heath, and shore grass. Under current conditions, no benefits or adverse effects to adjacent native habitats result from the operation. In addition, because the current operation does not result in any discharge of brine or water into the bay; no adverse effects to the habitats within the bay have been identified. The continuation of current management practices within the salt works would therefore not result in any adverse effects to surrounding habitats.

### **4.3.2.2 Alternative B –Enhance Nesting Habitat**

#### **4.3.2.2.1 Effects to Open Water, Subtidal, Intertidal, Coastal Salt Marsh, Freshwater Wetland, and Upland Habitats**

##### **Habitat and Wildlife Management**

Potential effects to the native habitats on this Refuge Unit as a result of expanded invasive plant species control would be similar to those addressed in Alternative B for the Sweetwater Marsh Unit. An increased law enforcement presence in the open waters of the Refuge would benefit Refuge habitats by reducing human disturbance in sensitive habitat areas.

### **Habitat Enhancement**

Because little if any native vegetation is supported on the interior levees of the salt ponds, the changes to the levees that are proposed to enhance nesting opportunities would have no adverse or beneficial effects to native habitat. The outer levees along Pond 11, which do support high marsh vegetation, would not be affected by this proposal.

No subtidal or intertidal habitat is present within the salt ponds due to the existing salinity levels, which exceed typical bay salinities. Therefore, the placement of fill material within the ponds to create additional nesting habitat for terns and plovers would not adversely affect any native vegetation.

The creation of new nesting areas within the salt works would convert some open water areas within the pond system to upland habitat. Although no adverse effects to existing intertidal or subtidal habitat would occur, the creation of these new nesting areas would represent a loss of wetlands, assuming the ponds to be affected historically supported wetlands and therefore meet the definition of a wetland under Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act. Based on the preliminary designs for nesting enhancements illustrated in Figure 2-7, between 20 and 25 acres of open water area could be lost to provide additional nesting habitat for colonial nesting seabirds, least terns, and western snowy plovers. The precise number of acres to be affected would be determined during project-level design and the processing of required Section 404 and/or Section 10 permits through the U.S. Army Corps of Engineers.

To avoid any net loss of wetlands as a result of the proposed enhancements, adequate wetland restoration would have to be provided to offset impacts to jurisdictional wetlands. The extent of the impacts would be determined during subsequent step-down planning and mitigation, if deemed necessary, could be provided through the restoration of intertidal wetlands within the Sweetwater Marsh Unit of the Refuge, as proposed under Alternative C. Preliminary restoration planning indicates that approximately 20 acres of wetland restoration could be implemented under this alternative.

### **Public Use**

Effects to Refuge resources would be the same as described for Alternative A.

### **Solar Salt Production**

Effects to Refuge resources would be the same as described for Alternative A.

## **4.3.2.3 Alternative C – Enhance and Restore Habitat/Expand Public Uses**

### **4.3.2.3.1 Effects to Open Water, Subtidal, Intertidal, and Coastal Salt Marsh Habitats Habitat and Wildlife Management**

Effects to Refuge resources as a result of the proposed management activities would be the same as described for Alternative B.

### **Habitat Enhancement**

Impacts to wetlands as a result of constructing new nesting areas, as described in Alternative B, would be more than offset by the restoration of between 63 and 88 acres of intertidal wetland habitat within the Otay River floodplain, as proposed under this alternative.

### **Habitat Restoration**

**Restoration of the Otay River Floodplain.** Restoring the Otay River floodplain in accordance with Restoration Options 1 or 2 could result in temporary, short-term impacts to the intertidal mudflat and coastal salt marsh habitat that extends up the Otay River channel from the bay to approximately 1,500 feet beyond the Nestor Creek confluence. Portions of this habitat could be damaged or lost as the area is graded to expand the marsh plain. Under a worst-case scenario, all of the existing habitat would be removed due to construction dewatering and/or grading resulting in a temporary loss of approximately 5.5 acres of intertidal mudflat habitat and coastal salt marsh vegetation. This loss would be more than offset by the restoration of 63 to 88 acres of tidally influenced habitat within this portion of the Refuge Unit. The benefits of restoration, which would be accomplished through a combination of active revegetation and natural recruitment, would include improved biological productivity within existing wetland areas and the reestablishment of the historic landscape in areas changed by human disturbance more than 100 years ago.

Transporting excavated material from the Otay River floodplain to the salt works where the excess soil could be used to enhance nesting areas or to raise the elevation levels within some ponds for the purpose of achieving elevations known to support cordgrass-dominated salt marsh habitat could result in some minor, short-term impacts to native habitat depending upon the access route used to transport the material across the Refuge. A temporary bridge could be placed over the Otay River channel, providing a connection between the Otay River floodplain and the southernmost levee of the salt works resulting in the temporary loss of less than an acre of salt marsh vegetation along the perimeter of the channel. This impact would be offset by revegetating the disturbed areas following construction, as well as by the restoration of at least 60 acres of salt marsh vegetation.

**Salt Pond Restoration.** Under Salt Works Restoration Option 1, approximately 200 acres of open water within the pond system with varying salinity levels would be converted to intertidal habitat, while the implementation of Salt Works Restoration Option 2 would convert approximately 440 acres of pond area to intertidal habitat. Restoration would require breaching portions of the pond levees to reintroduce tidal influence into the ponds, however, the majority of the levees would be retained in their current configuration to support historic seabird nesting.

To achieve the desired habitat types in these ponds, it would be necessary to recontour the bottoms of the ponds and in many cases, import fill material into the ponds to raise their elevations. Fill material proposed for placement in the ponds would be analyzed prior to placement to ensure appropriate grain size and soil chemistry.

Habitat restoration could occur through natural recruitment or through a combination of natural recruitment and the installation of plant material from appropriate sources elsewhere in the bay. As described in Chapter 3, no subtidal or intertidal habitat is currently supported within the salt ponds; therefore, no adverse effects to native habitat would result from these actions. Further, because so little of the historic coastal wetland vegetation that once occupied the south end of San Diego Bay still exists, the restoration of these ponds to intertidal and subtidal habitat would represent a significant benefit to the bay's ecosystem. This benefit would be greatest under Salt Works Restoration Option 2.

As described in Section 4.2.2.3.3 (Effects to Hydrology and Water Quality), breaching of the ponds under Salt Works Restoration Option 1 would result in a minor, temporary increase in the salinity levels within the bay as the water in the ponds mixes with the bay

water after the first low tide. The maximum salinity level within these ponds is approximately 40 ppt; therefore, the increase in salinity levels in the bay following initial mixing with bay water would be less than 40 ppt. Recorded salinity levels in the South Bay generally range from about 34 and 38 ppt, but can be lower when the bay receives freshwater input from winter rains (*Merkel & Associates 2000a*). Because this increase in salinity would only slightly exceed the average salinity level in the bay and this slight elevation in salinity would be short lived, no adverse effects to coastal wetland or marine aquatic habitats are anticipated as a result of opening Ponds 10, 10A, and 11 to tidal influence. To further reduce the effects of breaching, the ponds could be breached in the winter months when bay salinities are naturally lower.

Restoring all of the primary ponds to tidal influence, as proposed under Salt Works Restoration Option 2, would result in higher temporary increases in the salinity levels in the bay immediately following breaching, if the ponds are breached when full. The preferred approach to pond breaching would be to breach the ponds after they have been drained farther into the solar salt system, because the potential for measurable increases in bay salinity would be slight. Under a worst case scenario, the ponds would be full upon breaching. In this scenario, salinities in the bay in proximity to the ponds would peak at 50 ppt during the first ebb tide, then decrease to approximately 40 ppt one day after breaching. Salinity increases above 38 ppt would be limited to the areas south of the Chula Vista Wildlife Reserve and would only occur for a week following breaching.

Investigations into the effects of salinity on tide pool and subtidal forms of eelgrass occurring in the Izembek Lagoon on the Alaska Peninsula indicate that this species can tolerate a broad range of salinities. Leaf pieces suffered no damage when subjected to salinity levels ranging from distilled water to 93 ppt for up to three days (*Biebl and McRoy 1971*). In addition, respiration is only slightly affected at salinities ranging from 60 to 90 ppt, while photosynthesis decreases in both hypo- and hypersaline seawater (*Biebl and McRoy 1971*). Based on the data, Biebl and McRoy concluded that eelgrass was capable of maintaining a positive net production in salinities ranging from 0 to 56 ppt. The temporary increase (to 50 ppt) in bay salinities that would occur immediately following breaching appear to be well within the observed tolerance range for eelgrass, therefore, no significant adverse effects to the eelgrass beds in the south bay are anticipated under this alternative. Similarly, no impacts to widgeongrass (*Ruppia maritima*), which is also believed to tolerate a broad range of salinities (*Lieberman 2002*), would be expected from these temporary increases in salinity. Various studies conducted to examine responses to salinity variation in marine plants indicate that macroalgae tends to tolerate relatively broad salinity ranges (*Tornasko et al 1999*), although no specific studies have been identified for the species occurring within the South Bay. Based on the limited time (i.e., one week) in which marine plants would be subjected to higher salinity levels and the general tendency for marine plants to tolerate higher salinities, no significant adverse effects to plant life within the bay's open water or intertidal habitats from the proposed restoration plan would be anticipated.

#### **Public Use**

Fishing and recreational boating would continue to occur within the bay under this alternative, therefore, the potential effects of these uses on Refuge resources would be the same as those described under Alternative A. Expanded management activities, including the enforcement of Refuge regulations within the open waters of the bay, could reduce the potential for unauthorized activities such as the landing of boats on the outer levees of the salt works, which are closed to public access from the bay.

Disturbance to shorebirds and other migratory birds utilizing the intertidal mudflats located along the outer levees could also occur as a result of human activity associated with guided tours on the salt works and along the northern levee of Pond 11. To ensure that such disturbance is minimized during migration, the effects of human activity in proximity to these areas would be monitored over a period of several years to determine if disturbance is reducing the value of this habitat for migratory birds. If adverse effects are identified, the public uses would be modified to minimize disturbance.

Under this alternative, the northern levee of Pond 11 would be opened for recreational fishing and wildlife observation. Improvements required on the levee to accommodate these uses would necessitate the removal of some of the high salt marsh habitat that occurs along the slopes and edges of the levee top. Additional damage related to trampling of native vegetation could also occur as people attempt to access the edge of the bay. The significance of the impact to coastal salt marsh habitat would depend upon the extent of habitat removal that would be required to prepare this levee for fishing and wildlife observation activities, as well as the measures that are incorporated into the public access plan to minimize impacts to the remaining habitat. Under a worst case scenario, up to four acres of high marsh vegetation could be impacted. Once specific plans are developed for this proposal, additional evaluation of potential impacts would be conducted. Mitigation for any significant loss of high marsh vegetation would be provided through the restoration of this habitat within the Otay River floodplain (refer to Table 4-6 for specific acreages).

This alternative also includes a proposal to construct a pedestrian pathway between the southern edge of the salt ponds and the northern edge of the existing Bayshore Bikeway. The purpose of this pathway is to direct human activity away from the sensitive habitat areas on the Refuge by maintaining a defined pathway for pedestrian use that does not currently exist. This pathway would also provide a safe route for pedestrians to stop and observe wildlife within the Refuge without having to be concerned about the existing bicycle traffic on the Bayshore Bikeway. Many walkers currently choose to avoid conflicts with bicyclists by walking to the north of the bike path along the edge of Pond 10. This has resulted in the loss of vegetation and increased erosion along the edge of the pond. This activity would have even greater impacts once the western ponds are breached and restoration is implemented within the ponds. Removal of standing water in Pond 10 would make access onto the Refuge for people and their dogs much easier. The construction of a defined pathway should reduce inappropriate access along the edge of the pond and future intertidal wetland area, while also providing safe access for wildlife observation along the edge of the Refuge. No impacts to existing vegetation would occur as a result of constructing the pathway. In addition, increases in disturbance as a result of providing the pathway are not anticipated as human activity already occurs in this area in association with the Bayshore Bikeway.

To further reduce the potential for intrusion into sensitive coastal salt marsh habitat from the pathway, appropriate signage and fencing would be incorporated into the design of the pathway, as well as into the design of other wildlife observation sites proposed under this alternative. These measures would reduce the potential for adverse effects to below a level of significance.

### **Solar Salt Production**

The continuation of solar salt production under a reduced footprint would not impact native habitats within this Refuge Unit.

#### **4.3.2.3.2 Effects to Freshwater Wetland and Upland Habitat**

##### **Habitat and Wildlife Management**

Effects to Refuge resources would be the same as described for Alternative B.

##### **Habitat Restoration**

Restoration of the Otay River floodplain under Restoration Option 1 or Option 2 would involve the widening of the existing Otay River channel and would likely result in the removal of existing native and nonnative freshwater wetland vegetation. Although the grading required for restoration would result in short term adverse impacts to approximately three acres of native vegetation, these impacts would be more than offset by the proposed restoration of the Otay River floodplain. Under Otay Floodplain Restoration Option 1, approximately 10 acres of riparian habitat and six acres of freshwater marsh habitat would be restored, while under Restoration Option 2, approximately five acres of riparian habitat and 12 acres of freshwater marsh habitat would be restored. Restoration of these wetlands would reverse the adverse effects of decades of disturbance within the floodplain, representing a significant long-term benefit to the ecosystem.

##### **Public Use**

Trail construction and trail users can produce direct and indirect impacts to native habitats due to unauthorized off trail activities and/or inappropriate trail construction. Off trail activities by humans or dogs can result in habitat disturbance, loss of vegetation due to trampling or vandalism, and compaction of soil, which discourage revegetation by native species. Poor trail construction increases the potential for erosion within and adjacent to the trail, resulting in degraded habitat quality and loss of vegetation. Such disturbance would favor the establishment of non-native invasive plant species, which could lead to reductions in native plant species abundance and diversity.

To minimize such impacts to Refuge habitats as a result of the development of a portion of the Otay Valley Regional Trail, the future design and alignment of the proposed regional trail would be closely coordinated with the Refuge Manager. Currently the area proposed for the future construction of the regional trail is highly disturbed and dominated by non-native, weedy vegetation. Under these conditions, the impacts of trail construction and trail use on sensitive habitats would be minimal, although unauthorized off trail activity could result in impacts to native wetland vegetation. Once the upland habitats on this Refuge Unit are restored, the potential for impacts to native habitat would increase. Adverse effects to sensitive habitats could be minimized by siting the trail along the perimeter of the Refuge to avoid habitat fragmentation, ensuring that the trail is constructed with appropriate grades and outslloping to reduce the potential for excessive erosion, and requiring the installation of post and cable fencing or other appropriate fencing along the trail to discourage off trail activities by humans and dogs. Monitoring of trail activities by the staff and volunteers of the Otay Valley Regional Park would also reduce the potential for off trail activities and trespass onto Refuge lands.

##### **Solar Salt Production**

The continuation of solar salt production within a reduced footprint would have no effects on these habitats.

#### **4.3.2.4 Alternative D – Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)**

##### **4.3.2.4.1 Effects to Open Water, Subtidal, Intertidal, Coastal Salt Marsh, Freshwater Wetland, and Upland Habitats**

###### **Habitat and Wildlife Management**

Elimination of the commercial solar salt operation could have an indirect adverse effect on Refuge resources related to increased human disturbance. Currently, the operators of the salt works are present on the site throughout the day to deter unauthorized access onto the salt pond levees. Once the operation is eliminated, this presence would be removed, which could result in an increase in unauthorized entry into the area. To minimize this effect, expanded management activities would be implemented under this alternative. These activities would include the installation of fencing around the eastern perimeter of the salt ponds, placement of additional regulatory signage around the perimeter of the Refuge and along the outer levees, and routine visits to the area by Refuge staff. The effectiveness of these measures to reduce unauthorized access would be monitored and evaluated. If these measures are determined to be inadequate, additional measures would be developed and implemented to minimize access and reduce disturbance.

Restored upland and freshwater wetland habitats would benefit from the aggressive control of invasive plant species during native vegetation establishment. Monitoring within the restored salt ponds would also provide important data that could benefit future coastal restoration projects throughout the region.

The proposed managed water ponds within this alternative would provide benefits for marine vegetation provided pond salinities are maintained at or near bay salinities. The brine management ponds would lack most macro algae and salt marsh vegetation, but would sustain hypersaline phytoplankton and brine tolerant invertebrates. The managed ponds could result in localized adverse impacts to existing marine vegetation in the bay if salinity levels at the discharge point exceed 5 ppt above ambient levels for prolonged periods. To avoid adverse impacts, a water management plan, as described in detail in Section 2.3.2.4, would be prepared in association with the preparation of final restoration plans. This water management plan would establish the operating, maintenance, and monitoring activities and associated costs required to maintain these managed water systems. The data obtained from monitoring during the initial establishment of the managed water areas would provide information necessary to confirm that the system can be operated as proposed or that changes through adaptive management would be necessary to achieve desired habitat objectives.

###### **Habitat Restoration**

Under this alternative, approximately 650 acres of existing salt ponds would be restored to intertidal mudflat and salt marsh habitats. As described for Alternative C, the ponds proposed for restoration do not support any native subtidal or intertidal habitat due to the existing hypersaline conditions in the ponds. Therefore, this proposal would not result in any adverse effects to native habitat within the salt ponds. In addition, no mitigation for the conversion of salt ponds to tidally influenced habitat would be required, as no loss of wetlands would result from the proposed conversion. The same would be true for the conversion of the secondary and crystallizer ponds to managed water areas.



The restoration of the salt ponds to native coastal wetland vegetation would provide significant benefits to the bay ecosystem as a large area of the South Bay would again support the historic subtidal and intertidal habitats that once characterized the south end of San Diego Bay.

Implementing the proposed salt pond restoration would result in short-term impacts to water quality within the bay due to increased salinity levels following pond breaching. As described in Section 4.2.2.4.3 (Effects to Hydrology and Water Quality), the predicted salinity distribution within the bay following initial breaching would result in a maximum salinity of approximately 120 ppt during the first few hours of ebb tide due to mixing with the hypersaline waters within the secondary ponds. Increased salinities would generally be confined to the portion of the bay that extends from the Chula Vista Wildlife Reserve Reserve) south to the salt ponds and would range from about 50 ppt in the area immediately to the west of the Reserve to 120 ppt to the southwest of the Reserve. These salinities would decrease to approximately 60 ppt one day after breaching, to about 50 ppt within seven days, and to below 40 ppt after approximately two weeks. The affected portions of the bay would return to normal salinities in less than a month.

The temporary increase in salinity in the south end of the bay could adversely affect intertidal and subtidal, particularly eelgrass, habitat. In 2003, eelgrass beds were observed stretching from Emory Cove to just north of Pond 11 and just to the north of the intertidal mudflats that border Ponds 12 and 14. Some smaller eelgrass beds were also located near the mouth of the Otay River and to the south of the Chula Vista Wildlife Reserve (refer to Figure 3-8). In a prior survey conducted in 2000, no eelgrass was located in the immediate vicinity of the salt ponds, suggesting that the size and distribution of eelgrass beds within the bay fluctuates seasonally and on a year-to-year basis (*Merkel & Associates 2000a*). Eelgrass can disappear following a rapid loss of leaves from the plants and later reappear in the same location. It is not known if regrowth occurs as a result of seedling recruitment or recovery of surviving rhizomes. The presence of eelgrass in the bay declined significantly from late 1997 through 1998 during an El Niño period, but subsequently recovered to conditions equal to or greater than the conditions that existed prior to the El Niño period (*Merkel & Associates 2000a*).

Studies of the effects of salinity on eelgrass indicate that salinity levels in excess of 93 ppt would result in substantial damage to eelgrass foliage (*Biebl and McRoy 1971*); therefore, if salinities in excess of 93 ppt extend into existing eelgrass beds following the breaching of the secondary ponds, it is likely that vegetative damage to individual plants would occur. Based on the observations of eelgrass distribution in the bay overtime, as described above, it is likely that eelgrass damaged by the introduction of high salinities would be replaced by new growth; therefore, any adverse effects to this resource are expected to be temporary in nature.

The magnitude of the salinity increases experienced in the bay following breaching of the secondary ponds could be reduced by staggering pond breaching over time, rather than breaching them simultaneously. Other measures that could be taken include diluting the ponds with bay water prior to breaching or breaching the ponds after draining much of the brine from the ponds farther into the system by continuing to produce salt. No impacts to eelgrass would be anticipated if the ponds are drained through the salt making process prior to restoring them to tidal action.

Breaching the ponds during periods of freshwater input into the bay from the Otay River would also reduce the maximum salinity levels in the bay following breaching. The actual size, location, and timing of the breaches would be determined during development of the final restoration plans. Any breaching plan would consider the potential effects of breaching on both existing and proposed habitats. If implementation of this alternative occurs in phases, consideration must be given to the potential effects of breaching the secondary ponds on the restored habitat within the previously breached primary ponds.

If the ponds are breached under current hypersaline conditions with no attempts to reduce the salinities prior to breaching, an eelgrass monitoring and mitigation plan would be implemented consistent with the Southern California Eelgrass Mitigation Policy. Adherence to this policy would reduce short term adverse effects to eelgrass habitat to below a level of significance.

The discharge of diluted brine water from the managed brine ponds into the existing drainage channel between Ponds 15 and 28 would increase the salinity levels within this drainage by approximately 5 ppt. In addition, the volume and velocity of water flowing through this channel would likely increase. If these increases are substantial, some loss of intertidal habitat (up to two acres under a worst case scenario) within the channel could occur. The adverse effects resulting from the loss of some of the habitat within this channel would be more than offset by the restoration of approximately 650 acres of intertidal habitat within the salt ponds.

Effects to freshwater wetland and upland habitat would be the same as described for Alternative C, and any impacts to wetlands as a result of expanding available nesting areas within the salt pond complex, as described under Alternative C, could be more than offset by the restoration of intertidal wetlands within the Otay River floodplain (20 to 25 acres of impact versus 63 to 88 acres of restoration).

### **Public Use**

The effects of continued boating and fishing within the open bay would be the same as those described under Alternative A.

Impacts to existing and restored habitat as a result of guided nature tours of the restored salt works would be minimal due to the level of supervision to be provided.

The Habitat Heroes environmental education program would occur in an area located to the northwest of Bayside Elementary School, adjacent to a remnant coastal salt marsh area. Without proper supervision, disturbance to sensitive habitat, such as trampling of vegetation, could occur. Such impacts would be avoided by delineating sensitive habitats with post and cable fencing, or other appropriate fencing, and ensuring adequate supervision of students during educational programs.

Interpretive elements would be placed along an existing public trail in areas where off-trail human activity would be difficult due to topographic relief or where fencing is in place to discourage such activity. The potential for adverse effects to adjacent habitats is therefore considered negligible. The proposal to construct a pedestrian pathway along the southern edge of the salt ponds and Otay River channel would benefit native habitats by directing visitors away from the edge of sensitive wetland areas and onto the pathway.

## 4.4 Effects to Wildlife and Fisheries

The effects to wildlife and fisheries as a result of implementing the various alternatives are described below. Once again, potential impacts to these resources are characterized by evaluating direct, indirect, and cumulative effects. Direct impacts involve the primary effect of implementing an action, such as the flushing of foraging shorebirds as a result of wildlife observation activities. Indirect impacts include habitat modifications that result in a change in abundance or breeding success of a species (or group of species), such as increasing the availability of fish in the vicinity of seabird nesting areas following levee breaching. Cumulative impacts would occur when the incremental direct or indirect impact of an action is added to other related actions that would affect the same species (or group of species), such as the effect of modifying a habitat that provides foraging opportunities for raptors on the Refuge combined with the modification of the same habitat elsewhere in the region.

An effect to wildlife and fisheries would be considered significant if:

- An action would result in a substantial change in the amount or quality of available habitat of a wildlife species. (For wintering waterfowl, migrant and wintering shorebirds, or special status species, a substantial reduction in habitat resulting in a significant adverse impact would be defined as a reduction of 30 percent or more of the available acreage or quality of habitat for these species within the Refuge; a significant beneficial impact would be defined as a 30 percent or greater increase in the quantity or quality of habitat for wintering waterfowl, migrant and wintering shorebirds, or special status species.)
- An action would result in a substantial adverse effect, either directly or through habitat modifications, on any wildlife or fish species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by California Department of Fish and Game (CDFG) or USFWS or any avian species identified as a Bird of Conservation Concern.
- There would be a permanent loss (adverse effect) or gain (beneficial effect) of occupied sensitive species habitat or the direct mortality (adverse effect) of individuals of sensitive species as a result of a proposed action.
- An action would substantially interfere with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites for longer than two weeks.
- There would be a substantial reduction in the population abundance of fish species inhabiting San Diego Bay as a result of a proposed action.
- An action would substantially change in the availability of habitat for fish.

A significant cumulative impact would result from habitat modifications affecting wildlife and/or fish that would be considered minor for the proposed action but when considered in light of other similar losses within the region would be considerable.

#### **4.4.1 Sweetwater Marsh Unit**

##### **4.4.1.1 Alternative A – No Action**

###### **4.4.1.1.1 Effects to Waterfowl, Seabirds, Shorebirds, and Other Waterbirds**

###### **Habitat and Wildlife Management**

Various habitat management activities are currently implemented on the Sweetwater Marsh Unit to support a variety of waterfowl, seabirds, shorebirds, and other waterbirds. Some of these activities include invasive plant removal, litter and debris clean up, and brush management. These actions are generally implemented during the non-breeding season to avoid impacts to nesting birds. Law enforcement is implemented throughout the year to reduce disturbance to avian species due to unauthorized access into the closed portions of the Refuge. These management actions provide direct and indirect benefits to the Refuge's avian population. Therefore, the continuation of these management activities would not adversely affect the foraging, roosting, loafing, or breeding activities of these birds.

Monitoring of California least tern and western snowy plover nesting has been conducted annually on the D Street Fill and would continue provided funding continues to be available for this activity. Various studies have documented lowered reproductive success in nesting colonies subject to monitoring due to the effects of disturbance on adults, chicks, and eggs (*Carney and Sydeman 1999*). To reduce disturbance, monitoring protocols have been established that encourage monitoring to be conducted in the mornings to minimize heat stress to chicks and to identify tracks of potential predators. In addition, least tern colonies are generally only entered once a week, with additional monitoring to record nesting activity, egg and chick counts, and any evidence of predation conducted from behind the monitoring vehicle.

Monitoring can also provide indirect benefits to terns and plovers in the form of assisting in our understanding of how these nesting birds are adversely affected by predators, substrate conditions, and other external factors. This information can then be used to improve management practices in subsequent years. To ensure that monitoring activities are not resulting in excessive disturbance and consequently increased predation of chicks and eggs, the Refuge Manager will periodically review the monitoring protocols to make certain the benefits gained from monitoring are not outweighed by the losses caused by this activity.

Predator management activities implemented on the D Street Fill provide benefits to the federally-listed endangered California least tern and threatened western snowy plover, while potentially adversely affecting some individual problem gulls, particularly injured gulls. Although no gulls were removed from the D Street Fill nesting areas between 1999 and 2003, hazing has been implemented to discourage healthy gulls from harassing nesting terns and plovers. This activity would continue as needed under this alternative. Under the proposed Predator Management Plan, gulls could also be live-trapped, or if there is an immediate threat to nesting terns or plovers, problem gulls could be lethally removed. In addition, injured gulls found within the nesting colony would most likely be lethally removed. Western gulls (*Larus occidentalis*), which are known egg predators and have been observed feeding on eggs in the tern colony in the past, would be the species most likely affected by predator management. Other gull species, including the California gull (*Larus californicus*) and Heermann's gull (*Larus heermanni*), could also be subject to control on rare occasions. The control of problem gulls during the breeding season is rare

at the D Street Fill and would therefore have little effect on the total population of gulls within the Refuge and would have no effects on overall population levels.

#### **Public Use**

The existing trail system on Gunpowder Point provides access to the edge of the bay where expansive mudflats provide foraging habitat during low tides. Off-trail human activity in this area could result in disturbances to foraging migratory birds.

Disturbance to foraging and resting migratory birds, such as long-billed curlew and marbled godwit could also occur in the vicinity of the main access road (Gunpowder Point Drive) that crosses the marsh. This road is utilized by Refuge personnel, Chula Vista Nature Center staff, delivery and maintenance trucks, school buses, the shuttle bus that transports visitors to the Nature Center, and other individuals with business at the Nature Center or Refuge office. The level of disturbance appears to relate to the speed of the vehicles on the roadway, the number of vehicles using the roadway at any one time, and the distance of the birds from the roadway. Refuge staff has noted that the faster the vehicle is traveling, the greater the potential for disturbance (*Collins pers. com 2002*). In addition, the closer the birds are to the roadway, the more likely the birds are to flush. The posted speed limit on this access is 15 mph. Adherence to this speed limit would reduce the level of disturbance within the adjacent marsh. These effects although adverse do not represent a significant adverse effect to these Refuge resources.

#### **4.4.1.1.2 Effects to Land Birds**

##### **Habitat and Wildlife Management**

**Birds of Prey (Raptors)**. Management activities proposed under this alternative involving invasive plant species removal and debris clean up would have no beneficial or adverse effects on raptor species. Predator management, however, which would be conducted in accordance with the Predator Management Plan presented in Appendix M, could result in the relocation or lethal removal of certain individual problem raptors during the breeding season.

The Final EIS for Endangered Species Management and Protection Plan, Naval Weapons Station – Seal Beach, Seal Beach National Wildlife Refuge (*USFWS and U.S. Navy 1990*) includes a comprehensive analysis of the impacts to avian predators, particularly raptors that could occur as a result of implementing an avian predator management program. The analysis of the effects of predator management on mammalian and avian species that is provided in the EIS for Seal Beach has been incorporated by reference into this CCP/EIS. To summarize the findings of that document, the previous EIS concluded that native raptors would benefit from an increase in prey availability as a result of the control of mammalian predators in areas where endangered species are being protected. Those raptor species requiring management because of conflicts with endangered species would be impacted by removal of a few problem individuals. The adverse effects of predator control on the local and range-wide population of the affected raptor species were found to be insignificant.

Under the proposed predator management plan, the following raptors would be controlled when they pose a threat to endangered species, as determined by the Refuge Manager, the Refuge Biologist, or a qualified predator control contractor (e.g., USDA APHIS Wildlife Services): American kestrels, barn owl (*Tyto alba*), great horned owl (*Bubo virginianus*), burrowing owl, and red-tailed hawk. Actions affecting northern harriers, peregrine falcons, and short-eared owls would only be taken after consulting with the Refuge

Manager. Control of any of these species would only focus on problem predators, which are defined as individuals that belong to species known to prey on terns, plovers, or clapper rails and exhibit hunting behavior in nesting areas. Once an individual problem bird is identified, the most effective, selective, and humane tools available to deter, relocate, or if necessary lethally remove that individual would be implemented. Live captured raptors would be removed from the site and held in a licensed/permitted rehabilitation/holding center until they can be released back into the wild. Release would occur after the endangered species nesting season is completed and an appropriate release site has been approved by the Refuge Manager or Refuge Biologist. Raptors would be banded prior to release.

Past experience indicates that the American kestrel would be the most frequently controlled raptor on the Refuge. The first method to be implemented in the control of kestrels observed at the D Street Fill would be non-lethal removal using pole traps or Bal-chatri traps. Once trapped, individual birds would be banded and held at a licensed/permitted rehabilitation center until the end of breeding season when they would be released back into the wild. Release could take place in rural areas many miles away from the capture site. Similarly, initial control of individual problem owls, harriers, and hawks would involve the use of pole traps. Trapped birds would be held until the end of the breeding season and then released, generally a good distance from the nesting colony. If an individual is injured during trapping it would be taken to an approved rehabilitation center. If the injury is too extensive, the individual would be euthanized.

Shooting, calling/shooting, and spotlight/shooting of an individual problem predator would be selectively used when all other methods of control including trapping proves to be unsuccessful or when the immediate removal of a predator is necessary to avoid further loss of terns and/or plovers. Between 1999 and 2003, nine northern harriers were lethally removed after the individual birds were observed taking least tern adults and/or chicks. During that same period, one Cooper's hawk, one red-tailed hawk, and 21 kestrels were lethally removed, while 24 kestrels, one great horned owl, and three common barn owls were trapped and sent to Project Wildlife for relocation.

The control of specific raptors on the Refuge during the breeding season, as proposed in the Predator Management Plan, could result in a localized reduction in the number of individuals of these species occurring in south coastal San Diego County. However, the removal of individual problem kestrels from this nesting area would not adversely affect the overall population levels of this species in San Diego County.

The breeding population of northern harriers varies from year to year depending upon rainfall and prey availability. According to the San Diego County Bird Atlas (Unitt 2004), in any given year there appear to be between 25 and 75 pairs of harriers in San Diego County. The removal of one to two individuals from this Refuge Unit would not represent a significant adverse effect on the total breeding population, however, every effort would be made to avoid the lethal removal of harriers from tern and plover nesting areas within the San Diego NWR Complex to avoid significant adverse cumulative effects to the San Diego County's breeding population of harriers.

Impacts to target avian predator species would be minimized by ensuring that predator management is conducted in a scientifically sound and humane manner. A number of other management activities would also be implemented in an effort to reduce avian predation on nesting species. These activities include minimizing the number of potential perching sites

by removing non-native shrubs and unnecessary signs and fence posts and using Nixalite® or other anti-perching material on top of required poles and signs to prevent/reduce use by avian predators. Other anti-predation measures include providing concealment devices for chicks, such as roof tiles, or predator exclusion structures that are placed over active nests.

Other Land Birds. Predator management activities could result in the removal of individual problem land birds, such as common ravens and American crows, from tern and plover nesting areas. Other potentially affected land birds include loggerhead shrikes and European starlings. In addition, some non-target birds could be unintentionally captured in traps set for targeted problem individuals. In most cases, such birds are immediately released at the capture site. Only when serious injuries have been sustained during trapping would non-targeted individuals be euthanized. Between 1999 and 2002, only two non-target species were adversely affected as a result of predator management, a western scrub jay (*Aphelocoma californica*) and a northern mockingbird. The jay was released at the capture site, while the mockingbird was euthanized due to injuries.

Ravens and crows would be lethally removed from nesting areas if repeatedly observed entering or foraging within the nesting site. Between 1999 and 2003, 33 ravens were lethally removed from the Refuge. During that same time period, no crows had to be removed.

Loggerhead shrikes are also known predators of least terns. Individual shrikes observed on nesting sites or within 200 feet of a site on multiple occasions would be targeted for non-lethal removal from the site. Between 1999 and 2002, six shrikes were lethally removed from the Refuge and two were sent to Project Wildlife for relocation. No shrikes were controlled in 2003. Since the 1990s, the population of loggerhead shrikes in coastal San Diego County has declined significantly and even in relatively undisturbed areas the numbers of this species are declining (Unitt 2004). Therefore, the take of loggerhead shrikes as a result of predator management actions on the Refuge could adversely affect this species. The magnitude of the affect would be dependent upon the number of individuals removed in a given year, as well as the cumulative effects of removing offending individuals at other tern and plover nesting sites within coastal San Diego County. To minimize the effect of predator management on this species, predator management protocols would require that loggerhead shrikes can only be lethally removed from the Refuge after all other efforts to trap or otherwise remove the bird from the nesting area have been exhausted and there is documented evidence that the individual has taken a least tern or snowy plover. In addition, the protocols for removing offending shrikes will be reviewed annually to determine if changes are required as a result of the current status of the shrike population in coastal San Diego County and/or the number of individuals removed within the Refuge Complex during the prior nesting season.

European starling, a non-native species that has been documented to peck holes in tern and plover eggs, would also be lethally controlled when caught in cage traps. Between 1999 and 2001, 48 starlings were lethally removed from the D Street Fill. No starlings were removed in 2002 or 2003.

The control of ravens, crows, starlings, and shrikes during the breeding season could result in a localized reduction in the number of these birds within the Refuge lands; however, this reduction would not adversely affect the overall population levels within coastal San Diego County or California.



Management activities, such as the removal of invasive plants, potential perching areas, and litter and debris from around the nesting colony, would be implemented under this alternative to future reduce the need to control land birds during the tern and plover nesting season.

#### **Public Use**

The existing uses permitted on this Refuge Unit, particularly wildlife observation activities occurring along the existing interpretive trail, could result in some minor adverse effects to land birds as a result of periodic disturbance. No other adverse or beneficial effects are anticipated.

#### **4.4.1.1.3 Effects to Fish**

##### **Habitat and Wildlife Management/Public Use**

No adverse or beneficial effects to fish would result from the management actions and public use programs proposed under Alternative A. Short-term adverse impacts and long-term benefits to fish could occur as a result of implementing restoration related to the mitigation leasehold overlays. Additional NEPA review would be provided prior to the commencement of restoration activities related to the mitigation leasehold overlays.

#### **4.4.1.1.4 Effects to Invertebrates, Amphibians and Reptiles**

##### **Habitat and Wildlife Management/Public Use**

The Refuge operations proposed under this alternative would have limited potential for impacts to invertebrates, amphibians, or reptiles because of the limited area to be affected by such activities. In addition, any beneficial effects to these organisms as a result of habitat management would be minor. There would however be environmental consequences to these organisms if restoration occurs within the mitigation leasehold overlays. Additional NEPA review would be required prior to the commencement of restoration activities related to the mitigation leasehold overlays.

#### **4.4.1.1.5 Effects to Mammals**

##### **Habitat and Wildlife Management/Public Use**

The majority of the management activities implemented on the Refuge under this alternative would have no beneficial or adverse effects on mammals. Predator management, as described in Appendix M, could however result in the removal of individual mammals from the Refuge for the purpose of protecting the Refuge's endangered and threatened species.

Mammals subject to control under the predator management plan include all non-native mammalian predators observed on the Refuge (including feral dogs and cats). In addition, several native species of mammals that are common in urban and urban interface areas would also be subject to control, including the California ground squirrel, Virginia opossum, striped skunk, coyote, and gray fox. Non-target mammals that could be affected by predator management activities include rabbits and hares, which when trapped are immediately released near the site of capture or at another suitable location on the Refuge. With the exception of feral dogs and cats, all non-native mammalian predators are lethally removed (live-trapped and euthanized, or on occasion shot by an authorized agent for the Service). Native mammalian predators are lethally removed when they pose a threat to listed species. During the 2002 breeding season, 19 California ground squirrels, four black rats, and a feral cat released to an animal shelter, were removed from the vicinity of the D Street Fill to protect nesting terns. In addition, six Norway rats were lethally removed

and four ground squirrels were trapped and released during actions taken to protect the light-footed clapper rail from predation. Between 1999 and 2001, 54 ground squirrels, 12 Norway rats, six coyotes, two gray foxes, two striped skunks, one opossum, and one raccoon were removed from the Refuge during the California least tern and western snowy plover nesting season. No native mammals were removed in 1999 or 2001 in association with the protection of the light-footed clapper rail.

The control of native mammalian predator species on this Refuge during the tern/plover breeding season could result in a localized reduction in the number of coyotes, gray foxes, ground squirrels, striped skunks, and raccoons within the Refuge lands; however, this reduction in the local population would have no effect on the regional or range-wide population of these highly resilient species.

The public uses that would occur on this Refuge Unit would provide no benefits or result in any adverse effects to the Refuge's existing population of mammals.

#### **4.4.1.2 Alternative B – Habitat Enhancement/Interpretation**

##### **4.4.1.2.1 Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds, and Land Birds Habitat and Wildlife Management**

The management activities proposed under this alternative would provide a range of benefits to a variety of avian species, particularly migrating shorebirds and the light-footed clapper rail. These activities, which would improve habitat quality and/or reduce disturbance, include improving regulatory signage throughout the Refuge; installing fencing where necessary to minimize incidents of trespass; developing and implementing a public outreach program to increase the public's understanding of and adherence to Refuge regulations; and planting appropriate native vegetation within the upland transition areas following invasive species control.

The potential effects to some avian species as a result of implementing predator management would be the same as those described in Alternative A. In addition, the control of non-native vegetation, particularly non-native shrubs in the vicinity of the D Street Fill, would reduce available perching sites for raptors and shrikes, which could in turn reduce depredation of terns and plovers. This could also reduce the number of individual birds subject to predator management.

##### **Habitat Enhancement**

The construction associated with the various proposals to improve tidal circulation such as the removal or lowering of the weir at Paradise Marsh could result in short term adverse impacts to avian species due to disturbance. This disturbance would be limited in terms of duration and scope; therefore, no significant adverse effects to avian species are anticipated. To minimize disturbance during project implementation, all construction activity would be conducted outside of the breeding season and peak migration periods, and where possible, construction activity would be confined to the edges of sensitive habitat areas. Further, to reduce the amount of disturbance occurring within the Refuge at any given time, the implementation of enhancement projects would be staggered.

Removal of the abandoned roadbed within Sweetwater Marsh could disturb avian wetland species, such as clapper rails, egrets, herons, and a variety of shorebirds. This disturbance would be limited both in duration and total area affected. It is not likely that any species

would be displaced from the marsh, as there is adequate habitat to the north and south of the proposed enhancement area to accommodate the foraging, loafing, and roosting requirements of affected individuals. To minimize impacts to avian species during the removal of the old roadbed, construction activity would occur primarily within the disturbed footprint of the old roadbed and on the adjacent uplands. All activity would occur outside the breeding season and peak shorebird migration periods. In addition, construction routes and staging areas would be located in disturbed areas away from sensitive marsh habitat and the perimeter of the construction area and access routes would be fenced to avoid inadvertent access into sensitive area.

Installing an additional culvert within the current access road would result in similar short-term impacts to avian marsh species. In addition, some temporary loss of marsh habitat immediately adjacent to the road could occur as a result of construction access requirements, as described in Section 4.3.1.2. Construction would occur outside the breeding season and the peak shorebird migration periods, and any vegetation removed from the slopes of the road would be replaced with appropriate native species following construction.

Removal of the levee at the southern end of the marsh would occur in proximity to the bay and associated intertidal mudflats; therefore, construction activity would be limited during peak migration and during the winter months when black brant are abundant in this portion of the bay. More detailed plans are required for this proposal in order to fully evaluate the potential effect to existing waterbird habitat of removing the berm. It is however assumed that the potential impacts to marsh birds would be similar to those described for the removal of the abandoned roadbed.

Each of these improvements would be expected to improve the habitat quality within the marsh, resulting in long-term benefits to the avian species supported by the marsh complex. Specific benefits include improved habitat for and therefore increased availability of prey species, such as fish and macroinvertebrates, and enhanced vegetative cover within the marsh to support nesting and provide protection from predation.

Improved management, expanded site preparation, and enhancement of the existing nesting substrate, as proposed by this alternative for the D Street Fill, could improve California least tern and western snowy plover reproductive success. Such benefits would contribute to the recovery of these federally-listed species. No significant adverse effects to waterfowl or other seabirds, shorebirds, or waterbirds would occur as a result of enhancing nesting opportunities at the D Street Fill.

Enhancement projects intended to improve tidal circulation would occur adjacent to Belding's savannah sparrow habitat; therefore, the disturbance associated with construction activity could temporarily displace one or more sparrows during construction. Disturbance would not occur during the nesting season; therefore, adverse effects to this species would be expected to be minimal. No other land birds would be adversely affected by the enhancements proposed under this alternative.

### **Public Use**

Effects to these Refuge resources would be the same as described for Alternative A.

#### **4.4.1.2.2 Effects to Fish**

##### **Habitat and Wildlife Management/Public Use**

The effects of implementing the habitat and wildlife management activities described under this alternative would be the same as those described for Alternative A and no changes to the current public use program are proposed under this alternative.

##### **Habitat Enhancement**

The enhancements to tidal circulation that are proposed under Alternative B could result in minor short term impacts to fish during completion of required grading activities. The types of effects that could occur include decreased visibility for foraging activities; the possible loss of fish eggs, larvae, or juveniles if excavation is required within existing tidal channels, and temporary degradation of water quality as a result of increases in suspended sediments. Most fish would be able to avoid the affected areas during construction. Following completion of the enhancements, moderate benefits to fish would result. Such benefits include expanded opportunities for foraging within the marsh, increased availability of cover from predators for some species of fish, and additional habitat suitable for juvenile fish.

#### **4.4.1.2.3 Effects to Invertebrates**

##### **Habitat and Wildlife Management/Public Use**

The management activities and public uses proposed under this alternative would provide no new benefits or adverse effects to the Refuge's populations of invertebrates.

##### **Habitat Enhancement**

The enhancements to tidal circulation that are proposed under Alternative B could result in limited impacts and/or the direct loss of some marine and estuarine invertebrates in the immediate vicinity of proposed grading activities. These impacts would not adversely affect the Refuge-wide population levels of these organisms and following completion of the enhancements, these organisms would benefit from improved habitat quality due to increased tidal circulation within the salt marsh. No adverse or beneficial effects to terrestrial invertebrates are anticipated as a result of this activity.

Recontouring the steep slope along the southern edge of the D Street Fill in association with proposed nesting enhancement activities could impact a population of mudflat tiger beetles that were previously observed along the fringe of the mudflat and low marsh habitat near the southern end of the D Street Fill. The wandering skipper is another terrestrial invertebrate that could be impacted by vegetation removal associated with nesting enhancements on the D Street Fill. This species is often found in association with saltgrass, which could be removed during nesting site preparation. To avoid unanticipated impacts to sensitive terrestrial invertebrates, a survey of the area to be impacted by nesting enhancements would be conducted prior to project implementation and if such species are identified, appropriate measures, such as habitat protection, would be implemented to minimize adverse effects to these species.

#### **4.4.1.2.4 Effects to Amphibians and Reptiles**

##### **Habitat and Wildlife Management/Public Use Program**

The management activities and public uses proposed under this alternative would provide no new benefits or result in any significant adverse effects to the Refuge's amphibian and reptile populations.

### **Habitat Enhancement**

Construction activity related to the tidal enhancements proposed under this alternative is not expected to adversely effect amphibian and reptile populations supported on the Refuge due to the disturbed nature and limited size of the areas to be altered.

#### **4.4.1.2.5 Effects to Mammals**

##### **Habitat and Wildlife Management/Public Use**

The effects to mammals of implementing the predator management plan under this alternative would be the same as those described for Alternative A. None of the other management activities or public uses proposed under this alternative would be expected to benefit or adversely affect the mammals that occur on the Refuge.

### **Habitat Enhancement**

Construction activity related to the tidal enhancements proposed under this alternative is not expected to adversely affect native mammal populations on the Refuge.

#### **4.4.1.3 Alternative C –Habitat Restoration/Enhance Public Use (Preferred Alternative)**

##### **4.4.1.3.1 Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds, and Land Birds**

###### **Habitat and Wildlife Management**

The potential effects to some avian species as a result of implementing predator management would be the same as those described in Alternative A. Of the other habitat management activities included under Alternative C, those related to developing interagency partnerships to address watershed issues and design guidelines for adjacent development projects would likely benefit the avian species supported by the Refuge's coastal salt marsh habitat. No adverse effects to avian species would result from these activities.

###### **Habitat Restoration**

Under this alternative, approximately 13 acres of the D Street Fill are proposed for intertidal mudflat and salt marsh restoration and 33 acres would be retained as uplands to provide nesting habitat for the California least tern and western snowy plover. The 13 acres to be converted to wetland habitat have not historically supported seabird nesting despite past attempts to enhance the site for such purposes. Therefore, no adverse effects to nesting seabirds or plovers are anticipated.

Approximately ten more acres of nesting habitat would be preserved under this alternative than would be preserved under Alternatives A or B. Under Alternatives A and B as much as 23 acres of wetland habitat could be restored at the D Street Fill, while only 23 acres would be retained for nesting habitat. Although Alternative C provides potentially more benefit to nesting seabirds and plovers, it does not irreversibly commit this area to a particular habitat type. If over time the area is not utilized by nesting seabirds or plovers, it could be considered for restoration to appropriate coastal wetland habitat. However, as currently proposed, this alternative is intended to improve the reproductive success of the California least tern and western snowy plover, providing significant benefits in terms of protected nesting habitat free of direct human disturbance. Significant benefits to western snowy plover chicks would also be realized following completion of proposed improvements in access to important foraging areas located along the edge of adjacent tidal channels in the marsh.

The conversion of approximately 13 acres of the D Street Fill to intertidal habitat would result in temporary disturbances to relatively low numbers of waterfowl, waterbirds, seabirds, and shorebirds that forage and rest within the wetland habitats abutting this portion of the Refuge. Specific details regarding the extent of excavation required to achieve the desired intertidal habitats are not yet available; however, any impacts would be more than offset by the proposed restoration. By avoiding construction during the nesting season, adverse effects to breeding waterfowl, waterbirds, seabirds, and shorebirds would be minimized. The proposal to restore approximately 13 acres of coastal wetland habitats would provide moderate benefits to a variety of migratory birds by expanding the availability of foraging and loafing opportunities within San Diego Bay.

Short-term disturbance impacts similar to those described above would be expected during the restoration of the northern end of the F&G Street Marsh. To reduce impacts, construction activities would be limited to the disturbed portions of the marsh; construction access and staging would occur away from sensitive marsh habitat; and no construction would be permitted during nesting season. Expanded habitat and improved circulation would improve habitat quality within this marsh, representing a moderate benefit to the avian species.

On Gunpowder Point, restoration of upland habitat is proposed on approximately 25 acres and an additional two acres of salt marsh restoration is proposed along the northwestern edge of this upland area. The potential for impacts to avian wetland species is limited to minor disturbance associated with restoration activities that take place along the northern and western edges of Gunpowder Point. To minimize short-term impacts to species foraging or loafing in the adjacent salt marsh and intertidal habitat, construction activity would not occur during the breeding season or during peak migration periods. All construction activity would be restricted to the surrounding uplands and construction staging would occur away from sensitive habitat areas.

Birds of prey that forage on the D Street Fill and Gunpowder Point could be temporarily displaced from these areas during restoration. These short-term impacts are not considered adverse as the majority of the birds of prey that forage in these areas, also forage throughout the salt marsh complex. It is therefore unlikely that they would be displaced to areas outside of the Refuge. Following restoration, some of the uplands on the D Street Fill would be converted to salt marsh habitat and the disturbed areas of Gunpowder Point would be converted to upland scrub habitat. These changes are not expected to significantly alter the diversity or numbers of raptors that currently forage on the Refuge.

Other land birds could be permanently displaced from portions of the D Street Fill following restoration. By contrast, species such as the Belding's savannah sparrow would benefit from the proposed restoration both here and at the F&G Street Marsh. Restoration of native upland habitat on Gunpowder Point would most likely result in some increase in the diversity of land birds observed in this area. Overall, these changes would not represent a significant adverse or beneficial effect to land birds.

#### **Public Use**

Although no new uses are proposed under this alternative, the Refuge's current environmental education and interpretation programs would be expanded and opportunities for wildlife observation would be enhanced. To facilitate these expanded programs, the existing trail system on Gunpowder Point would be redesigned and new

interpretive elements would be provided along the realigned trail. A key design consideration for the future trail system is the emphasis on loop trails rather than trails that end at the edge of a sensitive habitat area. This redesign is expected to reduce unauthorized off trail activity, which would in turn reduce disturbance related impacts to avian species.

The Service would continue to regulate the speed of travel (a maximum of 15 miles per hour) on the main access road that traverses the marsh. In addition, to further reduce the level of disturbance in the marsh as a result of vehicular traffic on this access road, Refuge staff would work with the Chula Vista Nature Center in an effort to reduce the number of cars and trucks that travel on the main access road, particularly during migration.

#### **4.4.1.3.2 Effects to Fish**

##### **Habitat and Wildlife Management**

The management activities proposed under this alternative (reversing sediment accumulation trends in the marsh and working with other agencies to address local and regional issues related to improved water quality within the watershed) would provide long term benefits to the fish populations supported within the marsh complex.

##### **Habitat Restoration**

Under Alternative C, approximately 15 acres of disturbed uplands would be restored to tidal habitat within the Sweetwater Marsh wetland complex and an additional five to six acres of tidal habitat would be restored at the F&G Street Marsh. Although minor, short-term impacts to fish, as described above, could occur during the excavation of these areas, the resulting additional intertidal habitat would provide long term cumulative benefits for a variety of bay's fish population. These benefits include improved foraging habitat and expanded areas of habitat suitable for fish nurseries.

##### **Public Use**

Increasing opportunities for wildlife observation, environmental education, and environmental interpretation on Gunpowder Point would have no direct adverse or beneficial effects on fish populations within the Refuge. Indirect benefits could result from environmental education programs that stress the importance of protecting water quality within the watershed upstream of the marsh complex.

#### **4.4.1.3.3 Effects to Invertebrates**

##### **Habitat and Wildlife Management/Public Use**

The expanded management activities and public uses proposed under this alternative are not expected to adversely affect the Refuge's invertebrate populations.

##### **Habitat Restoration**

The restoration of tidal habitat on approximately 15 acres at the D Street Fill and the restoration of an additional five to six acres of tidal habitat at the F&G Street Marsh, as proposed by this alternative, could result in the loss of some terrestrial invertebrates during project grading. Such losses would be minimal and would not adversely affect overall population levels. Increasing the amount of intertidal habitat within the Refuge would provide long-term moderate benefits to a variety of marine and estuarine invertebrates by increase the area of available habitat and improving tidal circulation, which in turn improves water quality and the increases the availability of nutrients in the water column.



#### **4.4.1.3.4 Effects to Amphibians and Reptiles**

##### **Habitat and Wildlife Management/Restoration/Public Use**

No significant adverse effects to amphibians or reptiles would result from the implementation of the management activities proposed under this alternative. In addition, construction activity related to habitat restoration and public uses is not expected to adversely affect any amphibian and reptile populations supported on the Refuge.

#### **4.4.1.3.5 Effects to Mammals**

##### **Habitat and Wildlife Management/Restoration/Public Use**

No effects to the mammalian populations on the Refuge other than those related to predator management, as addressed under Alternative A, would occur as a result of implementing this alternative.

### **4.4.2 South San Diego Bay Unit**

#### **4.4.2.1 Alternative A – No Action**

##### **4.4.2.1.1 Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds, and Land Birds**

###### **Habitat and Wildlife Management**

The management activities currently being implemented on the Refuge including invasive plant removal, brush management, and major litter and debris clean up, would continue under this alternative. These actions are generally implemented during the non-breeding season to avoid impacts to nesting birds. Law enforcement is implemented throughout the year to reduce disturbance to avian species due to unauthorized access into the closed portions of the Refuge. These activities provide moderate direct and indirect benefits to the Refuge's avian population and would not adversely affect the foraging, roosting, loafing, or breeding activities of the avian species supported on this Refuge.

Under Alternatives A and B, foraging opportunities for least terns would be expanded by breaching either Pond 28 or 29 to restore tidal influence and improve fish habitat in proximity to historic least tern nesting areas. This proposal would provide moderate direct benefits to foraging terns and indirect benefits to a variety of other migratory birds. No adverse effects to any avian species are anticipated as a result of this action.

Endangered species monitoring, another activity proposed under this alternative, is conducted on the salt pond levees during the nesting season and would continue to result in periodic disturbances to the birds within the nesting colonies. Monitoring protocol results in short visits through the colony to record nesting activity, egg and chick counts, and any evidence of predation. Monitoring is conducted one to three times per week from mid-March through early October, with surveys of potential nesting, foraging, and roosting areas conducted weekly. Least tern nesting areas are entered weekly, as are peripheral sampling areas of larger nesting colonies of the larger species. To minimize disturbance, additional observations are made from along the perimeter road or at the periphery of the nesting areas using a vehicle as a blind. Monitoring is generally conducted in the mornings to minimize heat stress to chicks and to identify tracks of potential predators.

A number of investigations have been conducted to examine the effects of disturbance from monitoring on the reproductive success of seabirds (*Carney and Sydeman 1999*). In general, these studies have found that investigator disturbances lowered reproductive success of gulls, terns, and skimmers. However, some of these studies also indicate that adverse effects can be minimized by implementing appropriate protocols such as

minimizing the number of visits into the colony, visiting colonies early in the day to avoid thermal stress to chicks, avoiding unnecessary handling of chicks, and moving slowly when inside colonies (Carney and Sydeman 1999). Safina and Berger (1983) found that skimmers were more sensitive to disturbance early in the breeding season, as well as during egg-laying and early incubation phases. The effects of disturbance were significantly greater when the colony was disturbed daily rather than weekly. Frequent disturbance during these times can result in nest abandonment. This study also found that disturbance after chicks have hatched can cause chicks to run long distances from the nest often resulting in death.

At the salt works, monitors have noted that once they have completed their activities, adults rapidly return to resume incubation and/or brooding. Despite the disturbance associated with monitoring, this activity plays a critical role in ensuring that nesting birds are provided adequate protection from predators. Monitoring data also provides the Refuge Manager with relevant observations regarding nesting and fledging successes and failures that can be used to improve management practices in subsequent years. The effects of disturbance are therefore offset by the indirect benefits to fledgling success that can result from monitoring. To ensure that monitoring activities are not resulting in excessive disturbance and consequently increased predation of chicks and eggs, the Refuge Manager will periodically review the monitoring protocols to make certain the benefits gained from monitoring are not outweighed by the losses caused by this activity.

The control of invasive plants, such as giant reed and castor bean, within the Otay River channel would benefit a variety of native birds supported by riparian habitat, as well as the light-footed clapper rail, which has been observed in this area on occasion. There is the potential for short-term disturbance impacts to some of these species during plant removal. These effects are expected to be minimal because of the precautionary measures taken during plant removal and the application of herbicides and the avoidance of such activities during the nesting season.

Predator management, as described in Appendix M, would directly benefit federally listed species, including the endangered California least tern and light-footed clapper rail and the threatened western snowy plover. Other seabirds and shorebirds that nest at the salt works would also garner indirect benefits from the reduction in predators during the nesting season. Predator management activities would result in negative effects on other avian species, including raptors and loggerhead shrikes. Section 4.4.1.1.2 provides a detailed discussion of environmental consequences of implementing the predator management plan described in Appendix M. Additional information regarding the implementation of this plan is provided below.

Predator management activities to control avian predators at the salt works are conducted annually between the months of March and September. These activities would continue under this and the other alternatives presented for the South San Diego Bay Unit provided funding continues to be available for this activity. The species controlled in the greatest numbers between 1999 and 2004 include the common raven (with 65 lethally removed) and western gull (with 134 lethally removed, including a number of sick individuals). Both of these species are known egg predators. American crows are also subject to control; however, the number of individuals removed from the Refuge over the past few years has been very low.

American kestrels, barn owls, and northern harriers are also controlled, sometimes lethally; however, lethal take of these species is initiated only after trapping has provided to be unsuccessful. Individuals that are trapped are released to Project Wildlife for relocation after the nesting season. Kestrels, which are relatively abundant in urban/suburban areas, are highly efficient chick predators that can seriously impact the productivity of an entire nesting colony. Kestrels are typically live trapped and relocated some distance from the salt works. However, when a relocated kestrel returns to a tern or plover nest site, its chances increase of being controlled by lethal means because it is often trap wary and therefore difficult to manage by non-lethal methods. Between 1999 and 2004, six kestrels were lethally removed and eight were released to Project Wildlife. During that same period, one harrier was lethally removed and one was released to Project Wildlife for release after the nesting season. In 2004, one barn owl was lethally removed. In past years, barn owls have been a significant problem, requiring the trapping of 12 barn owls in 1999 and ten in 2000. All 22 owls were released to Project Wildlife for relocation. The effects to kestrels and northern harriers of predator management within the salt works would be the same as that described under Alternative A for the Sweetwater Marsh Unit.

Other potentially affected species include the California gull, great horned owl, loggerhead shrike, and European starling. It should be noted that no loggerhead shrikes were lethally removed or trapped and relocated between 1999 and 2004 at the salt works. Because the potential for control of shrikes in the future would exist under this alternative, the adverse effects and proposed mitigation measures described under Alternative A for the Sweetwater Marsh Unit would also apply to the South San Diego Bay Unit.

Gull-billed terns, which also prey on least tern and snowy plover chicks and eggs, were considered for control at the salt works during the development of the predator management plan. However, because of the desire to maintain/enhance the numbers of breeding gull-billed terns in Southern California, it was determined that no lethal control of this species would be considered at this time. Instead, scientifically based monitoring on a limited scale will be conducted at the salt works during the 2005 nesting season in an effort to obtain a better understanding of gull-billed tern foraging activities. Limited monitoring of gull-billed tern nesting and reproductive success will also be implemented. This activity would continue in subsequent years provided funding is available to support such a monitoring program.

Subject to available funding, additional actions to reduce chick predation by gull-billed terns that could be implemented in subsequent years include initiating a pilot project to experiment with different types of chick shelters for California least terns and developing an experimental design to better document avian predation on both least terns and snowy plovers. The Service's Migratory Birds Program would also continue to work with partners in Mexico to complete year two of a range-wide survey for gull-billed terns.

During the implementation of a predator management plan on the Refuge, some non-target birds could be unintentionally captured in traps set for targeted problem individuals. In most cases, such birds are immediately released at the capture site. Only when serious injuries have been sustained during trapping would non-targeted individuals be euthanized. Between 2001 and 2002, non-target species affected as a result of predator management at the salt works included one osprey, a Forster's tern, a black-necked stilt, a house sparrow, a black phoebe, and a northern mockingbird. The house sparrow, black

phoebe, and northern mockingbird were injured during trapping and had to be euthanized; the other birds were released at the capture site.

In 2000, peregrine falcons were frequently observed foraging within the salt works where pole traps had been placed to control other targeted avian predators. As a result, although not targeted for control, two peregrine falcons were live captured in the pole traps. These individuals were turned over to the Santa Cruz Predatory Bird Research Group where they were banded and released at Grizzly Island in northern California. This is the only time peregrines have been captured in pole traps in the South Bay, although the traps are often used in areas frequented by peregrines.

The control of avian species other than kestrels, harriers, and shrikes on this Refuge during the breeding season would result in a small, localized reduction in the number of native birds within the Refuge lands; however, this reduction would not adversely affect population levels in coastal San Diego County or California.

Additional activities to be implemented at the salt works under this alternative include enhancing the nesting substrate on some levees to improve nesting conditions for the California least tern and creating additional foraging area for terns. Substrate enhancement would be implemented during the non-nesting season; therefore, no adverse effects to breeding seabirds would occur. The benefits of this enhancement include reducing the potential for chick mortality that can occur within the existing sediments on the levees adhere to the young chicks' feathers and beaks following heavy fog and light rain showers, and expanding nesting opportunities by create more desirable nesting areas throughout the salt works. Converting all or a portion of Pond 28 or 29 to tidally influenced habitat would also benefit seabirds and shorebirds by providing additional isolated areas of foraging and loafing habitat. No adverse affects to other avian species are anticipated.

No other significant habitat enhancement or restoration proposals are included under this alternative; therefore, the salt works and the Otay River floodplain would continue to be maintained as they are at present. The Otay River floodplain under current conditions provides very limited benefits to most avian species because of the degree of disturbance that has occurred here in the past.

The existing commercial solar salt operation within the Refuge provides protected roosting and specialized foraging habitat for shorebirds and waterbirds, particularly during high tide, and isolated nesting habitat for the California least tern and western snowy plover, and other colonial nesting seabirds, shorebirds, and waterfowl. A byproduct of salt production is the creation of conditions conducive to the production of brine invertebrates, such as brine flies and brine shrimp. The availability of these organisms provides alternative foraging opportunities for some species and preferred foraging opportunities for invertebrate-feeding migratory species, such as phalaropes and eared grebes. Maintaining 90 acres of crystallizer ponds associated with salt production would provide only minor benefits to those few avian species that occasionally roost along the crystallizer ponds during periods of high tide.

### **Public Use**

Under this alternative, the uses currently permitted on the Refuge, including fishing, boating, wildlife observation, and wildlife photography, would continue. The implementation of these uses within the Refuge all have the potential to result in

disturbance to the avian species. The degree of disturbance would vary depending upon the use (*DeLong and Schmidt 2000, Huffman 1999, and Korschgen and Dahlgren 1992*). According to a human disturbance study conducted for the South San Diego Bay (*Huffman 1999*), of the various boating activities occurring in the South Bay, the greatest disturbance to the avian community came from motorized watercraft exceeding the speed limit.

Between January and March 1998, the effects of watercraft on wintering birds in South San Diego Bay were observed and recorded. The results of this study indicated that operating any watercraft (e.g. motorized boats, non-motorized boats, jet skis, wind surfers, parasurfing), within the South Bay resulted in some level of disturbance to waterbirds. The degree of disturbance depended upon the vessel's speed, proximity to rafting birds, proximity to the shoreline, and amount of noise produced during operation. During the study only 7% of motorized boats were observed obeying the 5 mph speed limit. The remaining 93% traveled at speeds that produced a wake (*Huffman 1999*). Disturbance was greatly reduced when boats traveled at the posted "No Wake" speed (5 mph). Reactions to disturbance were greater within 150 meters of the salt pond levees and Chula Vista Wildlife Reserve shoreline than they were further to the north where boating and fishing activity is generally more frequent. Observations made during waterbird surveys conducted between April 1993 and April 1994 confirmed that areas with relatively low water recreational intensity supported a greater abundance of waterbirds (*USFWS 1995*). The effect of motorized watercraft on shorebirds foraging along the edge of the bay was also studied (*Huffman 1999*). Observations indicated that watercraft within 100 meters off the shore flushed all waterfowl between the boat and shore and any shorebirds along the shoreline regardless of the speed of the watercraft. This was also true for windsurfers traveling less than 100 meters offshore. Similarly, when non-motorized vessels, including kayaks, canoes, and longboats, came within 30 meters of the shoreline all waterfowl between the craft and the shore would flush.

Based on the observations of the various studies described above, it would appear that boating activity conducted in accordance with existing speed restrictions would have only minor adverse effects on migratory birds in the open bay. However, adverse effects to shorebirds feeding and loafing along the shoreline and on the surrounding mudflats would be greater if frequent motorized boating activity occurs within 100 meters or non-motorized watercraft activity occurs within 30 meters of such foraging areas.

Disturbance to nesting seabirds at the salt works from activities associated with watercraft can occur when a vessel approaches too close to the outer levees or when a watercraft is landed on the levees allowing human encroachment into nesting areas. Access to the outer levees is possible for low draft watercraft during high tides, although such occurrences have been rare. Seabird responses to such disturbance vary with date, nature of the disturbance, and other unknown factors. These responses can include flocking, alarm calling and in some species, diving on individuals present along the levee. Human disturbance early in the nesting season can result in the entire nesting colony abandoning the site. Nest abandonment and inter-colony antagonistic behaviors that lead to crushed eggs and chick mortality may result from such disturbance episodes. Predatory species often take advantage of these disturbance responses by stealing eggs and chicks while the adults are flocking or otherwise distracted. Breeding colonial waterbirds are particularly susceptible to impacts related to disturbance because of their high-density nesting habits (*Rodgers and Smith 1995*).

In addition to potential adverse effects to waterfowl and seabirds related to disturbance, recreational fishing on the bay can also result in indirect impacts to the avian species supported by the Refuge. These impacts, which can be lethal, relate to the accumulation of fishing line along the outer levees and within the bay. Shorebirds, seabirds, waterfowl, and pelicans can become entangled in improperly discarded fishing line resulting in the death of the bird. This problem would be expected to continue under this alternative.

Opportunities for wildlife observation, which would be provided under this alternative, include observing wildlife in the bay from watercraft and participating in guide tours of the salt works. To minimize disturbance to nesting birds from wildlife observation activities, no guided nature tours are conducted during the nesting season, and disturbance during the remainder of the year is minimal because only one or two tours conducted each month during the nonbreeding season.

#### **Solar Salt Operation**

Continuation of commercial salt production on the Refuge could result in some limited disturbance to foraging and loafing shorebirds, seabirds, and waterfowl; however, the presence of the commercial operator on this site also benefits avian species by maintaining the isolated nature of the site through strict enforcement of no trespassing regulations. During the nesting season, disturbance from the commercial operation is avoided by prohibiting activities on those levees known to support nesting birds. The low frequency of disturbance and the isolated nature of the salt ponds provide a benefit to colonial seabirds that return to this site each year to nest.

#### **4.4.2.1.2 Effects to Fish**

##### **Habitat and Wildlife Management/Public Use**

The reintroduction of tidal influence into Pond 28 or 29 under Alternative A or B would expand to some extent the area of available fish habitat within the South Bay. No other benefits to fish would result from the implementation of Alternative A. Also under this alternative, some incidental fish loss would occur as a result of fishing activities permitted within the open waters of the Refuge, and other fish would be lost as a result of being trapped in the salt ponds after entering the system through the tide gate in Pond 10.

#### **4.4.2.1.3 Effects to Invertebrates, Amphibians, and Reptiles**

##### **Habitat and Wildlife Management/Public Use**

No adverse or beneficial effects to invertebrates, amphibians, and reptiles would occur as a result of implementing this alternative.

#### **4.4.2.1.4 Effects to Mammals**

##### **Habitat and Wildlife Management**

With the exception of the implementation of predator management, the management activities and public uses proposed under this alternative would have no beneficial or adverse effects on mammals. Mammals subject to predator management would be the same as those described in Alternative A for the Sweetwater Marsh Unit. During the 2002 breeding season, 20 California ground squirrels, 13 black rats, seven striped skunks, three opossums, three Norway rats, three feral cats which were released to an animal shelter, a coyote, and a bobcat were removed from the Refuge to protect nesting terns. The continued control of native mammalian predator species on this Refuge during the breeding season could result in a localized reduction in the number of coyotes, ground

squirrels, and striped skunks within the Refuge lands; however, this reduction would not adversely affect the overall population levels of any of the target species.

#### **Public Use**

Continuing to permit limited public access within this Refuge Unit for fishing, boating, wildlife observation, and environmental education would have no effect on the mammals supported on this Refuge Unit.

### **4.4.2.2 Alternative B –Enhance Nesting Habitat**

#### **4.4.2.2.1 Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds, and Land Birds Habitat and Wildlife Management**

In addition to the management activities included in Alternative A, Alternative B also includes proposals to initiate a public outreach program intended to reduce the accumulation of improperly discarded fishing line and other debris in the bay and expand current law enforcement activities by conducting periodic patrols within Refuge waters in an effort to control boating speeds within the Refuge boundary. Both of these proposals would provide benefits to the Refuge's avian species. The effects of predator management on avian species under this alternative would be the same as those described under Alternative A.

Management of the Refuge under this alternative would also include the continued operation of the salt works in essentially the same configuration as described in Alternative A and no restoration of the Otay River floodplain. Many of the potentially adverse effects and benefits to avian species described under Alternative A would also be realized under this alternative.

#### **Habitat Enhancement**

The creation of 18 acres of nesting habitat within the salt works and enhancement of up to an additional ten acres of existing nesting area on the levees would improve nesting opportunities for the colonial nesting seabirds and shorebirds that nest in the South Bay. Added nesting area should reduce competition for nesting space and vulnerability to predators, while potentially also improving reproductive success. Enhancement of the substrate on the levee tops would also eliminate the adverse effects created when the existing silty substrate mixes with rain to form a glue-like substance that sticks to young chicks as it dries, often leading to the death of the chick. This benefit should contribute to improved fledgling success.

Recontouring some of the side slopes along the levees would improve chick access to the edge of the ponds where foraging opportunities exist. Some levees would remain unaltered to minimize the loss of nesting and brooding habitat for American avocets and black-necked stilts.

Lowering the water level in Pond 20 to create some salt flats within the pond during the breeding season would create potential nesting sites for the western snowy plover, which could result in improved fledging success. The low water levels and exposed surfaces would also provide benefits for foraging shorebirds and other waterbirds, particularly during periods of high tide.



Some of the levee slopes support pickleweed and upland transition vegetation that is used by Belding's savannah sparrows for foraging and nesting. To minimize the loss of sparrow habitat as a result of levee enhancements, a survey would be conducted prior to the completion of a detailed levee enhancement plan to identify those sparrow habitat areas to be preserved. No other impacts or benefits for waterfowl or land birds would result from the proposed nesting substrate enhancements.

#### **Public Use**

Public uses would not be expanded under this alternative; therefore, the effects to these Refuge resources would be the same as those described for Alternative A.

#### **4.4.2.2 Effects on Fish**

##### **Habitat and Wildlife Management/Public Use Program**

No new adverse or beneficial effects to fish would result from the management actions proposed under Alternative B and no new public uses are proposed under this alternative. Minor losses of individual fish would continue as a result of fishing and the operation of the salt works, as described for Alternative A.

#### **Habitat Enhancement**

The seabird nesting enhancements proposed under this alternative would occur entirely within the confines of the salt works; therefore, these proposals would have no direct adverse or beneficial effects on the fish populations within the bay. These improvements could however lead to indirect adverse effects to fish if the number of fish-eating birds using these nesting areas increases following enhancement. This potential adverse effect is not however considered significant.

#### **4.4.2.3 Effects to Invertebrates, Amphibians, Reptiles, and Mammals**

##### **Habitat and Wildlife Management/Public Use**

The effects to these organisms would be the same as those described under Alternative A for the South San Diego Bay Unit.

#### **Habitat Enhancement**

The seabird nesting enhancements proposed under this alternative would have no effect on the invertebrate, amphibians, reptiles, or mammalian populations within the Refuge.

### **4.4.2.3 Alternative C – Expand and Restore Habitat/Expand Public Uses**

#### **4.4.2.3.1 Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds, and Land Birds**

##### **Habitat and Wildlife Management**

The habitat management activities described in Alternative A and B would also be implemented under this Alternative; therefore, the potential adverse and beneficial effects of implementing these actions would be the same as those described for the previous alternatives.

#### **Habitat Enhancement**

The proposals to improve seabird and western snowy plover nesting opportunities within the salt pond complex, as described in Alternative B, would also be implemented under this alternative. These actions would be expected to improve nesting habitat quality for the various species of birds that nest at the salt works. No adverse effects to avian species are anticipated as a result of implementing this proposal.

### **Habitat Restoration**

#### ***Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds***

Otay River Floodplain. The construction activities required to restore the Otay River floodplain under either Option 1 or Option 2 could have short term, adverse impacts to the low numbers of seabirds, shorebirds, waterfowl, and other waterbirds that utilize the habitats within the Otay River channel for foraging, loafing, roosting, and/or nesting. Impacts would range from the temporary displacement of avian species due to grading activities in and around the river channel to some loss of existing habitat. Option 1 would have a slightly greater impact on existing wetland resources than Option 2, because all of the Otay River channel would be reconfigured under Option 1. Under Option 2, the northern portion of the channel would remain unchanged. The construction period would be longer for Option 2, as more earthwork would be required to achieve the restoration objectives. Restoration activities within the upland areas of the floodplain would also temporarily eliminate potential terrestrial foraging areas for raptors and other land birds, as well as the gull-billed tern. The proposed restoration activities could displace some of the affected species for up to two years, depending upon the length of time required for revegetation of disturbed habitat. During this time suitable habitat for displaced species would continue to be available to the south and east of the refuge and within the southern portion of Pond 20A.

To avoid impacts to the light-footed clapper rail, a directed survey for this species would be conducted prior to construction. Any individuals observed would be removed from the area and maintained at an appropriate facility until they can be safely released back into the restored habitat. Monitoring would also be conducted during construction in an effort to avoid the loss of any previously unobserved clapper rails. Although there remains a potential for short-term adverse impacts to this species, restoration once completed would provide significant benefits to the clapper rail in the form of expanded foraging and nesting habitat and overall improvements in habitat quality.

The proposed restoration would provide significant long term benefits to waterbirds, seabirds, shorebirds, and waterfowl as 63 acres of tidally influence coastal salt marsh habitat and 19 acres of freshwater wetland habitat would be restored under Option 1; a total of 88 acres of tidally influenced coastal salt marsh habitat and 17 acres of freshwater wetland habitat would be restored under Option 2. Restoration of habitats that historically dominated the southern end of San Diego Bay would significantly increase the availability of foraging and roosting areas.

Salt Works. Salt Works Restoration Option 1 would result in the restoration of approximately 213 acres of intertidal habitat. As a result of converting these ponds to tidally influenced areas, some avian species (e.g., eared grebes, phalaropes) could be displaced, while other avian species would benefit from expanded foraging opportunities. Shorebird species in particular would benefit from the restoration of salt marsh and exposed mudflat habitats. This conclusion is supported by observations made in 1984 when a large salt pond adjacent to Elkhorn Slough was inadvertently exposed to tidal action. Following the failure of a dike and the introduction of tidal action into the pond, shorebirds that had not been previously observed feeding within the pond began to feed on the new intertidal mudflat (*Ramer, Page, and Yoklavich 1991*).

Surveys conducted at the salt work in 1993/1994 found that the ponds to be restored under Option 1 supported a high diversity of bird species, with 54 species observed in Pond 11, 59

species in Pond 10, and 57 species in Pond 10A (Stadtlander and Konecny 1994). In terms of the total abundance of birds present in the ponds, 201 to 1000 individuals per hectare were observed in Ponds 10 and 11 and 1001 to 4000 individuals per hectare were observed in Pond 10A. The group or guild most represented in Pond 11 was waterfowl, due in part to the observation of a significant number of lesser scaup in the pond in February 1993. Lesser scaup were also highly abundant within those cells surveyed to the north of the Pond 11 in the open bay. Other waterfowl such as bufflehead, American wigeon, gadwall, and northern shoveler (*Anas clypeata*) that occurred in high or moderate numbers within these three ponds were also found at similar abundance levels in the open bay. The only exceptions were red-breasted merganser (*Mergus serrator*) and ruddy duck, which were more abundant in these ponds than in the open bay, although they were also observed at moderate abundance levels in all cells surveyed within the open bay.

A review of the various species observed within these ponds suggests that the guild of birds mostly likely to be displaced as a result of converting these ponds from open water to a tidal regime would be waterfowl. Waterfowl would still be expected to occur in these ponds, but not at the numbers observed under existing conditions in which the water levels in the ponds are considerably more stable. Waterfowl that presently raft in these ponds would most likely move to other ponds in the system or to the adjoining open bay. Overall waterfowl diversity and abundance within the Refuge is therefore not expected to be adversely affected.

The foraging and rafting activities of phalaropes and eared grebes would be affected by the changes in the pond system as a result of implementing Option 1 (the 1,060 acres commercial salt operation would be reduced to about 815 acres), although these effects are not expected to significantly alter the use of the pond complex by these species. Eared grebes are routinely observed rafting on the majority of the ponds within the existing salt works, with highest densities occurring in the ponds located to the east of the Otay River. Phalaropes are observed primarily within the ponds to the east of the Otay River, as well as along the mudflats to the north of the salt works. Confining the salt operation to the east side of the Otay River is not expected to significantly reduce resting and foraging opportunities for either eared grebes or phalaropes.

During low tide, foraging and loafing opportunities for herons, egrets, and shorebirds, which frequent these ponds, would be expected to increase as a result of restoration, and during high tide, greater fish diversity and abundance would be present in the ponds, additional foraging opportunities for migrating and nesting seabirds. The current roosting opportunities available to gulls, pelicans, and cormorants along the levee that separates Ponds 10 and 11 would not be altered; however the conditions surrounding this levee would change from an open water environment to a tidal regime. To better understand the effect, if any, on the roosting habits of these birds as a result of restoration, bird activity on this levee would be monitored during and following restoration of Pond 11. Any changes in roosting patterns would be recorded and analyzed to determine if modifications to proposed restoration plans for Pond 10 are necessary to ensure the continued use of this levee for roosting.

Large areas of cordgrass-dominated salt marsh with adequate tidal flushing are considered the preferred habitat areas of the light-footed clapper rail (*Jorgensen 1975 in U.S. Navy 2000*), a perilously endangered species that currently occurs in extremely low numbers in the southern end of the bay. The intent of this restoration option is to create

sufficient acres of relatively secure clapper rail habitat to significantly benefit the region's clapper rail population.

Salt Works Restoration Option 2 proposes to convert all of the primary ponds, a total of approximately 510 acres, to intertidal habitat. The restoration in Ponds 10, 10A, and 11 would be identical to that proposed in Option 1; therefore, the potential adverse and beneficial impacts of restoring these three ponds to tidal influence would be the same as previously stated.

Restoration of the eastern primary ponds would involve raising the elevations in Ponds 12 and 13 with the intent of providing additional cordgrass-dominated salt marsh, while simple breaching would support intertidal mudflats in Ponds 14 and 15. Similar to Restoration Option 1, restoration of all the primary ponds would displace rafting waterfowl to the remaining ponds in the system and/or to the open bay. However, many of these species would be expected to forage in the restored intertidal areas since biological diversity and productivity is expected to increase once tidal influence is restored.

The extent of change to the salt pond system proposed under Option 2 could result in the displacement of other species, such as phalaropes and eared grebes. Under this alternative, commercial salt making would continue but within a reduced footprint (the 1,060 acres commercial salt operation would be reduced to about 520 acres), and the total area available to phalaropes and eared grebes for resting and foraging would be reduced accordingly. Brine flies, brine shrimp, and other invertebrates associated with hypersaline environments would continue to be supported within the pond system, but their distribution within the remaining ponds would change from existing conditions and the overall densities of brine shrimp and brine flies would be reduced. No data is currently available that can help us predict how the use of these ponds by eared grebes and phalaropes could change following restoration. To improve our understanding of existing prey densities and overall avian reliance on the brine invertebrates in the existing pond system, baseline studies would be conducted during step down planning.

Jehl (1988) describes phalaropes and eared grebes as “behaviorally flexible” and able to readily exploit new situations. Therefore, the shift in location and density of brine invertebrates within the ponds may have no adverse effects on these species. Conversely, a reduction in the availability of brine invertebrates could result in one or more of these species abandoning their use of the salt ponds as a foraging site during migration. Should eared grebes and/or phalaropes abandon the site, the loss of these species would represent a slight reduction in the overall avian diversity within Refuge, representing an adverse but less than significant effect. Further, because the number of birds that visit this site each year represents a small percentage of the total population of these species, no significant adverse effects to the overall population of eared grebes, northern phalaropes, and Wilson's phalaropes are anticipated. This issue would be examined in greater detail during the preparation of final restoration plans, when additional information regarding prey densities and avian reliance on this resource is available from baseline studies.

The eastern primary ponds currently provide little foraging habitat value for fish eating birds. However, once tidal influence is restored to these ponds, foraging opportunities for those seabirds that nest within the salt pond complex, as well as for a variety of other gulls, terns, and pelicans routinely observed on the Refuge, would increase. Providing high quality foraging habitat in proximity to nesting areas would represent a benefit to the Refuge's nesting seabirds, particularly the endangered California least tern.

The preliminary restoration plan for the salt ponds includes the proposal to maintain the majority of the exterior and interior levees within the salt pond complex in order to preserve existing roosting, loafing, and/or nesting opportunities for terns, gulls, pelicans, and shorebirds. Restoration would however change the setting, as the open water that currently surrounds many of the levees would be replaced by intertidal mudflat and salt marsh habitat with water levels fluctuating with the tides. Concern about the effect that these changes could have on nesting seabirds has been raised by various stakeholders. Unfortunately, adequate data is not available to allow the Service to state with certainty what the outcome of the proposed changes would be. Therefore, we must evaluate the potential effects of this proposal by reviewing the information that is available in the literature and taking into account our own field experiences and observations. Based on this analysis and the Service's best professional judgment, we believe that the seabirds that nest at this site would not abandoned the site simply because the open water that currently surrounds most of the levees was replaced with intertidal habitat.

Based on the literature, which describes the nest site characteristics of the various species of terns that nest at the salt works, those characteristics that attract these birds to the salt pond levees likely include: the isolated nature of the salt pond complex; the open to sparsely vegetated conditions on the levee tops; the excellent visibility of the surrounding area from the levees; the proximity of the site to bay and ocean foraging areas; the indirect benefits of an active predator management program at the site to conserve listed species; and the presence of other breeding tern species on the levees (Buckley and Buckley 2002, Burness et al. 1999, Cuthbert and Wires 199, Parnell et al. 1995). All of these conditions would be maintained under this management alternative.

As stated, no research has been conducted that would support an accurate prediction of how nest site selection could be effected by this change in conditions around the levees. Further, even under existing conditions, nesting patterns and species abundance and diversity at the salt works varies, sometimes significantly, from year to year. This is particularly true of the elegant tern, which has a particularly erratic nesting history at the salt works. As conditions within the salt works are changed, there is the potential that one or more species could be displaced either temporarily or permanently, although we believe that the later result is unlikely. This conclusion is based on a review of the conditions surrounding other colonial seabird nesting sites on the Pacific Coast. Examples include Bolsa Chica and Upper Newport Bay. At Bolsa Chica, two nesting islands created within a tidally influenced impoundment support a variety of colonial nesting seabirds including Caspian, Forster's, elegant, and royal terns, and black skimmers (Seto et al 2003). Both of these islands are surrounded by intertidal salt marsh habitat. Similarly, two islands in Upper Newport Bay Ecological Reserve currently provide nesting habitat for California least terns (~25 pairs), Forster's terns (colony size unknown) and black skimmers (300-350 pairs) (Seto et al 2003). These islands are situated within an existing tidal flat, with no water body separating the islands from the mainland during low tide. At this location, Caspian terns do not nest on the islands, although they do forage and roost in the vicinity. Similar to the current proposal for the salt works, the tidal flats and salt marsh that surround the islands in Upper Newport Bay are managed for the light-footed clapper rail. Other examples include the Seal Beach NWR, where California least terns nest in an area surrounded by salt marsh habitat (Buck pers. comm.), and Isla Montague in the Gulf of California, where elegant terns have been observed nesting on islets surrounded by low

marsh vegetation (*Burness et al 1999*). Gull-billed terns, Forster's terns, and black skimmers have also been observed nesting along the outer levees of the salt ponds within the South San Diego Bay Unit (refer to Table 3-14), where the levees abut the intertidal mudflats of San Diego Bay (*Stadtlander and Konecny 1994, Patton 1999, 2004a, 2004b, 2004c, 2006b*).

Included as part of this alternative are additional management activities that would be implemented to maintain those conditions that we believe support seabird nesting along the salt pond levees. Such activities include continuing to enhance the substrate on the levee tops, providing additional nesting areas within the confines of the salt works, installing additional fencing and regulatory signage around the salt pond complex to minimize human and mammalian disturbance in the nesting colonies, and monitoring and periodic removal of vegetation on the levees to maintain open views of the surrounding area for the nesting seabirds. Tern species including gull-billed, royal, and elegant terns appear to prefer nesting sites with good visibility; therefore, where necessary, the clearing of vegetation along the levees prior to the nesting season would be a priority for maintaining high quality nesting habitat for these species (*Parnell et al 1995, Buckley and Buckley 2002, Burness et al 1999*). Restoration of the salt ponds would also provide new fisheries habitat in proximity to these nesting areas, which is also consistent with the nesting site selection characteristics identified for several of the tern species that nest at the salt works.

In addition, nesting activity on the levees would continue to be monitored prior to, during, and after restoration to determine the effects, if any, of the changed conditions within the salt works on the various nesting seabird colonies. Over the years, seabird distribution and abundance at the salt works has varied in response to a variety of factors, including shifts in the abundance of preferred prey species in the adjacent marine environment due to climatic changes (*Horn and Dahdul 1998*). Therefore, interpretation of the monitoring results would consider the conditions in the immediate vicinity of the levees, as well as those of the surrounding area. If abandonment of one or more of the seabird colonies does occur following restoration, specific management actions would be developed and implemented in an attempt to reestablish the colony. Such actions could include: 1) intensifying predator management actions, if predation is determined to be the cause for abandonment; 2) reducing disturbance related to public use on the levees, boats operating adjacent to the levees, and/or monitoring activity that occurs within the colonies; and 3) restoring an open water component around some of the levees or other nesting areas by constructing moat-like structures adjacent to the nesting area. These and other adaptive management actions would be more fully defined as part of the final restoration plan.

Restoration of the primary ponds within the salt works is not expected to adversely affect nesting black-necked stilts or American avocets, which nest on various levees throughout the salt pond complex (refer to Table 3-14).

#### ***Effects to Land Birds***

Otay River Floodplain. Restoration of the Otay River floodplain under Option 1 or Option 2 would convert approximately 140 acres of non-native grassland to a combination of freshwater wetland, coastal salt marsh, and native shrub habitats. The loss of these grasslands could reduce foraging opportunities for species, such as the red-tailed hawk and white-tailed kite, which feed on small mammals supported by this habitat. This loss of foraging habitat would not represent a significant direct adverse effect for these species; however, it would contribute to the cumulative loss of similar habitat throughout the

region. These cumulative effects would be offset by the preservation of foraging habitat for these species within the San Diego NWR, which is located further to the east.

Other birds of prey, such as northern harriers, falcons, and osprey, that regularly forage in estuarine habitat could benefit from this restoration. The effects to these raptors of implementing one restoration option over the other would be indiscernible.

Land birds, such as mourning doves, western meadowlarks, and Brewer's blackbirds that are supported primarily by open grassland habitat could be displaced by the conversion of the nonnative grasses to native wetland and upland scrub vegetation. These effects would be partially reduced for some species, such as towhees, common bushtit, and finches, by establishing native vegetation on the restored upland areas.

The implementation of Restoration Option 1 would increase the total acreage and quality of the riparian habitat within the Refuge by restoring approximately 13 acres of southern willow scrub habitat along the Otay River channel. Establishing willows and mulefat within the river channel would provide habitat known to support two federally listed endangered species, the least Bell's vireo and southwestern willow flycatcher. These species occur upstream within the Otay River drainage and in the adjacent Tijuana River Valley, but have not been observed within this Refuge. The improved habitat quality of the freshwater wetlands within the Otay River floodplain would also benefit several other land birds associated with freshwater habitats including common yellowthroat, red-winged blackbirds, wrens, and swallows. Although Option 2 would also provide potential benefits to the least Bell's vireo and southwestern willow flycatcher, only five acres of southern willow scrub habitat are proposed, therefore, the benefits to these species would be less than those provided under Option 1.

Other land birds, such as Belding's savannah sparrow and belted kingfisher, would benefit from the increase in wetland habitat proposed under either restoration option, with Option 2 providing slightly higher benefits than Option 1.

Salt Works. The conversion of salt ponds to intertidal habitat, as proposed in Salt Works Restoration Options 1 and 2, would have no adverse effects on raptors. Osprey, which occasionally forage on fish trapped in the primary pond system, would benefit from pond restoration as the diversity and abundance of fish in these ponds would be expected to increase following breaching. Other birds of prey, including northern harriers and falcons, that forage in salt marsh habitats would also benefit from the expansion of this habitat into the South Bay.

Belding's savannah sparrow would benefit from the increase in salt marsh habitat that would occur under either restoration option for the salt works.

Horned larks are not expected to be adversely affected by the implementation of either Option 1 or Option 2, because all of the levees where they have been observed nesting between 1999 and 2004 would be maintained. Further, the implementation of Option 1 is not expected to have any effect on the foraging activities of the various species of swallows present within the salt works. Although restoration under Option 2 would alter the availability of brine flies within the salt pond complex, brine flies would still be present in the system under this alternative, therefore, no significant adverse effects to the swallows that forage in this area are anticipated.



### **Public Use**

**Recreational Boating.** Recreational boating would continue to be permitted within the bay under this alternative, resulting in effects to avian species that would be similar to those described under Alternative A. The proposal to increase enforcement of the existing speed limit within the bay would be expected to reduce existing incidents of disturbance due to excessive boating speeds in the South Bay.

**Onshore Fishing and Wildlife Observation.** Under this alternative, fishing would be permitted within the open bay, as well as along the northern levee of Pond 11. The effects of recreational fishing in the bay on avian species would be the same as those described under Alternative A. Fishing activity along the northern levee of Pond 11 could result in disturbance to birds foraging and loafing on the existing and restored mudflats and salt marsh habitat located adjacent to the levee. The potential for disturbance is documented in various studies conducted to evaluate the effects of public uses on wildlife (*DeLong and Schmidt 2000*). Some of the adverse effects of disturbance include alterations in behavior, reproduction, and distribution. Disturbance to migratory birds as a result of pedestrian activity along the shoreline has been observed in South San Diego Bay; with the greatest disturbance occurring during low tides when pedestrians left designated accessways to explore the mudflats (*Huffman 1999*). This activity impacted both shorebirds and waterfowl. Huffman observed that human activity along the shoreline and in the mudflats would flush all birds within a 50 to 100 meter radius; therefore, human activity on this levee could result in disturbance both to the north and south of the levee. The level of activity to be permitted on this levee under this alternative could result in frequent disturbance to adjacent foraging areas, resulting in lost foraging time and additional energy expenditure for migrating birds. In modeling the energy costs of such disturbance for oystercatchers, West et al (*2002*) concluded that when the time and energy costs arising from disturbance are considered, frequent disturbance can be more damaging to migratory birds than permanent habitat loss. Therefore, opening this levee to human activity could adversely affect migratory birds by effectively reducing the availability of foraging habitat in proximity to the levee. This impact would be offset by the proposal to restore significant areas of tidally influenced habitat throughout the salt works, which would provide alternative foraging areas for migratory birds displaced by this human disturbance.

Opening this levee to human activity would also adversely affect Belding's savannah sparrows that occupy the high marsh habitat growing along the slopes of the levee. Human disturbance in these areas could result in the permanent displacement of these individuals to other portions of the Refuge.

Human intrusion into sensitive habitat areas during low tide could also occur as a result of opening this levee to public access. The South Bay Biological Study Area, located immediately to the north of the levee, provides nesting and foraging habitat for the light-footed clapper rail and the area to the south of the levee is intended to be restored to habitat known to support clapper rails. The repeated presence of humans in these areas could disrupt natural behaviors, such as foraging, brooding, and tending of young. With enough disturbance, birds may abandon the area altogether in search of more suitable habitat. To minimize the potential for human intrusion into adjacent areas, subsequent plans for preparing this levee for public use would incorporate effective measures for restricting access to the levee.

For the past several seasons, tern colonies have been located on the levee surfaces east of the Otay River channel several hundred of meters away from Pond 11's northern levee.

Biologists performing seabird nesting surveys report that these colonies may respond to pedestrian traffic on the west side of the Otay River along the levee surfaces. Responses, which vary with date and the nature of the disturbance, include flocking, alarm calling and in some species, diving on individuals present along the levee. Nest abandonment, colony abandonment and inter-colony antagonistic behaviors leading to crushed eggs and killed chicks can also occur during disturbance episodes. Predatory species may also use disturbance episodes to depredate eggs and chicks while the adults are flocking or otherwise distracted. Responses to disturbance from activities on the levee would be monitored to reduce the potential for adverse effects to nesting seabirds as a result of permitting public access along the north side of Pond 11. If adverse effects are observed, access to some or all of the levees would be restricted during the nesting season.

As described in Alternative A, fishing activity can also result in indirect adverse effects to avian species as a result of the accumulation of fishing line along the shoreline and within the shallow areas of the bay. Opening the levee to shoreline fishing could increase the accumulation of discarded fishing line within the Refuge. Proposed public outreach and organized clean ups could minimize, but not eliminate, the threat that discarded fishing line would pose to migratory birds, rails, and seabirds. In addition, public access on the levee would result in some level of trash accumulation. Trash, discarded bait, and other materials even when discarded in approved receptacles can attract gulls, ravens, and crows that are common predator species of seabird chicks and eggs. If trash accumulation becomes a threat to fledging success, it may be necessary to close this levee to public access during the nesting season.

Under this alternative, Pond 11's northern levee would also be available for activities related to wildlife observation and photography. Although indirect impacts related to fishing line accumulation would not result from these uses, the potential for other direct and indirect impacts, as described above for fishing along the levee, would also be expected for any uses that involve public access on the levee.

Guided Tours of the Salt Works. Opportunities for wildlife observation and photography and environmental interpretation would also be provided through the proposal to conduct routine (twice a month) guided nature tours along the outer levees of the salt works. To avoid adverse effects to nesting seabirds, these tours would not be conducted during the nesting season. Disturbance and possible displacement of migratory shorebirds could occur if guided tours result in excessive out-of-vehicle activity. Observations on other Refuges indicate that out-of-vehicle activity is more disruptive to avian species than vehicular movement through an area (*Klein 1993 in DeLong and Schmidt 2000*). Although the degree of disturbance may vary for the species and local populations of birds occurring within the South San Diego Bay Unit, similar differences between out-of-vehicle activity and vehicle travel on the salt works would be expected. If the disturbance level is too excessive, the avoidance response by migratory birds could increase and some species may avoid foraging habitat located near the tour route. The benefits of the proposed tours to avian species include making the public more aware of the need to reduce disturbance to migratory birds and providing the public with an appropriate means for observing the birds within the Refuge. These lessons are expected to help reduce inappropriate public intrusion into sensitive habitat areas for the purpose of observing the Refuge's wildlife.

Environmental Education. The environmental education program proposed for the area located to the north of the Bayside Elementary School is not anticipated to result in any adverse effects to avian species, as the level of disturbance would not increase over existing

conditions. The benefits of this program to avian species include educating students about the need to conserve habitat for a wide variety of avian species and teaching them the importance of reducing disturbance in those native habitats that have been conserved.

Environmental Interpretation. The primary interpretive program under this alternative would involve working with other agencies to develop a coordinated interpretive program around the bay. Interpretive elements in the vicinity of the Refuge would be installed along the Bayshore Bikeway, where public access is already permitted. The potential for disturbance of avian species in adjacent habitat areas would not increase, and could decrease, as a result of interpretation.

Otay Valley Regional Trail. Another use considered under this alternative is the designation of a future trail corridor, intended to accommodate the Otay Valley Regional Trail. The trail would be aligned along the eastern boundary of the Refuge, in proximity to I-5. Studies indicate that the physical presence of a trail and the human disturbance associated with the trail can effect bird abundance, species composition and nest predation in the immediate vicinity of a trail (*Delong and Schmidt 2000*). Through proper trail planning that limits fragmentation of habitat, avoids sensitive habitat areas, and establishes clearly defined paths to reduce off trail activities, many of these potential effects can be avoided. The proposed trail would be located at the edge of the Refuge away from sensitive coastal wetlands and seabird nesting areas; therefore, no adverse effects to shorebirds, seabirds, waterfowl, or waterbirds are anticipated.

#### **4.4.2.3.2 Effects to Fish**

##### **Habitat and Wildlife Management/Public Use**

The Refuge operation activities and expanded public uses proposed under this alternative would provide no new benefits or adverse effects to fish populations within the Refuge.

##### **Habitat Enhancement and Restoration**

Short-term impacts to fish as a result of implementing Otay River Floodplain Restoration Option 1 or 2 would be minimal (refer to Sweetwater Marsh Unit, Alternative B); however, the restoration of 60 to 90 acres of intertidal habitat would result in moderate benefits to various fish species, particularly those species that breed, spawn, and/or forage in the intertidal zone. Expanding the availability of salt marsh habitat adjacent to the bay would provide new foraging and spawning areas for a number of fish species known to occur in the bay, as well as provide these species with cover to protect them from predators.

The restoration of the salt works under Salt Works Restoration Option 1 would result in temporary salinity increases in the South Bay, as described in Section 4.2.2.3.3. Salinity increases would be relatively minor and short in duration; therefore, these changes are not expected to adversely affect the fish population in the South Bay. Restoration under Option 2 would result in slightly higher temporary increases in the salinity levels in the bay immediately following breaching. Assuming the ponds are full upon breaching, salinity increases above 38 ppt would be limited to the areas south of the Chula Vista Wildlife Reserve and to the first week following breaching. Salinities would peak at 50 ppt during the first ebb tide and would decrease to approximately 40 ppt one day after breaching. Although few studies have been conducted to determine the salinity tolerances of the fish species that occur in San Diego Bay, a study of salinity tolerances in a number of fish species in Los Penasquitos Lagoon provides some observations regarding the salinity tolerances of several of the more abundant fish species in the South Bay. Specifically, California killifish and topsmelt were observed to be thriving in Los Penasquitos Lagoon at

salinity levels as high as 63 ppt, while California halibut appear to tolerate salinities of between 50 and 55 ppt (Carpelan 1961). In this same study, the upper limit for pipefish appeared to be about 50 ppt and 55 ppt for Shiner surf perch. Based on these observations, it would appear that these species would be unaffected by the short-term increase in salinity that would occur under this alternative. Other species that may be less tolerant of salinity increases could swim north to areas of the bay that would not be impacted by this temporary increase in salinity levels. The temporarily displacement of these fish would not adversely affect fish diversity or abundance within the South Bay.

Significant benefits to fish would result from the establishment of vegetated tidal marsh within the breached ponds. These vegetated marsh areas would provide foraging habitat for adult and juvenile fish, protected spawning areas, and cover from predators.

#### **4.4.2.3.3 Effect to Invertebrates**

##### **Habitat and Wildlife Management/Public Use**

The management activities and public uses proposed under this alternative would result in no new adverse or beneficial effects to these organisms.

##### **Habitat Restoration**

Some loss of terrestrial and freshwater invertebrates could occur as a result of restoring the Otay River floodplain in accordance with Option 1 or 2; however, these losses are expected to be minimal. To avoid unanticipated impacts to sensitive terrestrial invertebrates, a survey of the restoration area would be conducted prior to project implementation and if the potential for adverse effects to such species are identified, appropriate measures would be implemented to minimize these effects. The restoration of 60 to 90 acres of intertidal habitat, as proposed under this alternative, would significantly benefit a variety of marine and estuarine invertebrates by expanding available habitat and increasing tidal circulation, which results in improved water quality and the increased availability of nutrients.

The restoration of the western primary salt ponds (Salt Works Restoration Option 1) would result in temporary salinity increases in the South Bay that would not be expected to adversely affect marine and estuarine invertebrates. Although restoration under Salt Works Restoration Option 2 would result in slightly higher temporary increases in the salinity levels in the bay immediately following breaching, the levels are not considered high enough to result in adverse effects to the bay's invertebrate populations. Once tidal influence is restored to the ponds, it is anticipated that marine and estuarine invertebrates would once again become established within this portion of the Bay. These organisms would derive significant benefits from the availability of expanded habitat and improved tidal circulation.

#### **4.4.2.3.4 Effects to Amphibians and Reptiles**

##### **Habitat and Wildlife Management/Public Use**

The management activities and public uses proposed under this alternative would not adversely affect or provide benefits to these organisms.

##### **Habitat Restoration**

Restoration of the Otay River floodplain could displace some amphibian and reptile species currently supported by this upland area. To date, no surveys have been conducted to determine if sensitive species currently occupy this area. To avoid unanticipated impacts to sensitive reptiles and amphibians, a survey of the restoration area would be conducted

prior to project implementation. If a significant population is identified, the restoration plans would be revised to protect the population from any significant adverse effects.

#### **4.4.2.3.5 Effects to Mammals**

##### **Habitat and Wildlife Management/Public Use**

The effects of predator management on the Refuge's mammalian population would be the same as those described under Alternative A. The other management activities and public uses proposed under this alternative would result in no new adverse or beneficial effects to these organisms.

##### **Habitat Restoration**

Restoration of the Otay River floodplain would convert disturbed upland area that supports a variety of native and non-native mammals to coastal wetlands. This action could displace some mammals, while continuing to support others. Despite these changes, no significant adverse effects to the mammalian populations in the vicinity of the Refuge are anticipated.

#### **4.4.2.4 Alternative D –Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)**

##### **4.4.2.4.1 Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds, and Land Birds**

Implementation of this alternative would result in benefits to avian species as a result of restored freshwater wetland, native upland, and coastal salt marsh habitat within the Otay River floodplain and the availability of a combination of tidally restored ponds and managed ponds within the existing salt works. Changes within the salt ponds could displace some avian species that rely on the resources within the active salt ponds, although this alternative does include a brine management component that is intended to provide habitat conducive to the production of brine invertebrates. Unlike the other alternatives being considered, this alternative proposes to convert the entire salt works system into habitat types suitable for supporting a variety of avian species. The other alternatives propose the continuation of salt production in some form. This would result in retaining a portion of the Refuge, specifically the crystallizer ponds, in a condition that would provide little if any habitat value for wildlife.

##### **Habitat and Wildlife Management**

The habitat management activities described in Alternative A and B would also be implemented under this alternative. The potential adverse and beneficial effects of implementing these actions would be the same as those described for the previous alternatives.

##### **Habitat Enhancement**

The potential effects of implementing the proposals to improve seabird and western snowy plover nesting opportunities within the salt pond complex, as described in Alternative B, would be the same as those described for Alternatives B and C.

##### **Habitat Restoration**

The restoration options described in Alternative C for the Otay River floodplain are also proposed under this alternative; therefore, the adverse and beneficial impacts to avian species described in Alternative C would also be realized under this alternative.

Under existing conditions, the salt ponds provide approximately 970 acres of water surface within a configuration in which the salinities in the system progressively increase from ambient bay levels (about 33 ppt) at the initial intake ponds (the primary ponds) to about 370 ppt in the crystallizer ponds. The primary and secondary ponds support a variety of avian species, as described in Chapter 3. Under this alternative, approximately 670 acres of water surface within the ponds would be converted to tidally influenced habitats ranging from subtidal to pickleweed-dominated salt marsh. An emphasis would be placed on restoring cordgrass-dominated salt marsh habitat to support the light-footed clapper rail. Preliminary restoration plans also propose the retention and long-term maintenance of the existing levee system to support California least tern and western snowy plover nesting, as well as to continue to support the colonial nesting seabirds the utilize the site.

The total acreage of each habitat type to be provided within the restored ponds would be determined during final restoration planning, however, for environmental analysis purposes acreages for the various habitat type have been calculated based on the preliminary restoration plan presented in Figure 2-15. These acreages, which assume some alteration of the existing pond elevations to achieve the desired habitat types, include approximately 45 acres of shallow subtidal habitat, 125 acres of intertidal mudflats, 445 acres of cordgrass-dominated salt marsh habitat, and 32 acres of pickleweed-dominated salt marsh habitat. If the ponds were to be breached with no changes to the current pond elevations, the restored ponds would be expected to support approximately 300 acres of intertidal mudflats, 230 acres of pickleweed-dominated salt marsh, and 115 acres of cordgrass-dominated salt marsh. The alternative also includes the proposal to retain approximately 270 acres of unbreached ponds as managed water areas, with approximately 40 acres to be maintained at salinity levels that support brine invertebrate production and the remainder to be maintained at salinity levels similar to those in the adjacent bay.

Following the conversion of the majority of the ponds to tidal influence, invertebrate species richness and abundance would be expected to increase within the breached ponds, while the high biomass of brine invertebrates, including brine flies and brine shrimp, currently available in many of the ponds would shift to the 44-acre area designated for brine management. There is not sufficient data available to predict how this shift in prey availability might affect avian diversity and abundance in San Diego Bay.

Based on observations of shorebird use in salt ponds throughout the world (*Stadtlander and Konecny 1994, Warnock et al 2002*), it appears that migratory bird use of salt ponds is generally higher during high tide than during low tide. This is attributed to the fact that the ponds provide protected loafing areas during high tide (*Stadtlander and Konecny 1994*) and can also provide additional foraging opportunities when extra foraging time is needed to recover from migration (*Velasquez 1992*). Conversion of the salt ponds to various intertidal habitats would continue to provide opportunities for protection from the high tides, as would those ponds that are retained for water management. The water levels in the managed pond could also be controlled to provide opportunities for extra foraging time for shorebirds during pre- and post-migration periods.

Phalaropes, eared grebes, and American avocets tend to be abundant within the salt ponds during both high and low tide and could be displaced as a result of a reduction in the widespread availability of brine invertebrates. The effects of displacement could be reduced by the proposal to provide approximately 44 acres of brine ponds that would be managed to optimize conditions for the production of brine invertebrates. As discussed in Alternative C, phalaropes and eared grebes have been described as “behaviorally flexible”

(Jehl 1988). It is therefore possible that these species would adapt to the proposed changes in the salt pond functions and continue to stop to forage within the managed ponds during migration. It is also possible that these species would change their migration pattern and select an alternative stop over site such as the Salton Sea. The loss of these species from the South Bay would have an adverse effect on the overall avian abundance within the Refuge, but would not be expected to represent a significant adverse effect to the overall population of eared grebes, northern phalaropes, or Wilson's phalaropes.

Potential effects to waterfowl as a result of pond breaching are described in Alternative C. Waterfowl seeking safe, calm water loafing areas often settle in the existing salt ponds. Once the ponds are breached, these waterfowl would likely relocate to the bay or to the managed water area proposed under this alternative. Many of the ponds that currently support hypersaline conditions and are rarely used by waterfowl would be integrated into the managed pond system. Here, bay water would be circulated through the ponds and a variety of water levels would be maintained to optimize conditions for waterfowl and shorebirds.

The current conditions in the ponds provide little benefit for foraging seabirds. Breaching the ponds would increase fish diversity and abundance in the primary pond system and reintroduce fish into the secondary ponds, thus increasing prey availability of seabirds and other waterbirds. Herons, egrets, and terns could also benefit from increased fish densities in the vicinity of the discharge point for the brine management area, as the high density of brine shrimp in the discharged water would be expected to attract an abundance of fish.

The potential effects to nesting seabirds of restoring tidal influence to the salt ponds would be similar to those described for Alternative C. Alternative D does however include a proposal to convert Pond 44 to nesting habitat, providing approximately 18 additional acres of nesting habitat for seabirds and snowy plovers. This nesting area would be surrounded by open water, which would allow for a comparison of the effects to nesting seabirds of being surrounded by water versus being surrounded by intertidal habitat. As proposed under Alternative C, the level of activity and composition of species within the nesting colonies would be monitored prior to, during, and after completion of the proposed restoration to document any changes in nesting patterns that might occur. Various measures, as described under Alternative C, would be implemented to maintain the current nesting characteristics of the levees, and if any adverse effects to nesting seabirds are noted, the measures described in Alternative C to address this situation would also be implemented under Alternative D. In addition, under this alternative, security fencing would be installed immediately following the closure of the salt works to minimize unauthorized access onto the pond levees.

To minimize the potential for adverse effects related to long-term erosion of the levees, which support seabird nesting, this alternative includes a monitoring and maintenance component that would require periodic monitoring of levee integrity and the implementation of measures to reduce erosion of the levees over time. Control of vegetation growth on the levees would also be provided and would focus on removal of non-native species and maintenance of native vegetation to retain access to the shoreline by western snowy plover chicks and maintain open views of the areas surrounding the levees for nesting seabirds.



Existing foraging areas for American avocets and black-necked stilts would be altered under this alternative; however, based on the current distribution of avocets and stilts in San Diego County (Unitt 2004) it is likely that these species would continue to be supported on the Refuge. These species would be expected to forage both in the restored tidally influenced areas and within the managed water areas of the South San Diego Bay Unit. Historic nesting areas for these species in the ponds proposed as managed water area would be maintained, as would the majority of the levee system within the salt pond complex.

The effects to land birds as a result of implementing this alternative would be the same as those described under Alternative C.

### **Public Use**

The potential effects to avian species as a result of recreational boating and fishing within the bay would be the same as those described under Alternative A and B. The potential adverse effects related to shoreline fishing on the northern levee of Pond 11 would not occur under this alternative, as no public access would be permitted on this levee under this alternative.

The potential effects of implementing regular guided nature tours along the restored salt ponds and developing an environmental education program adjacent to Bayside Elementary School would be similar to those described under Alternative C.

As described in detail under Alternative C, human activity in proximity to foraging and loafing birds, particularly shorebirds and waterfowl, reduces foraging time for these birds and can result in the unnecessary expenditure of energy when birds are flushed due to disturbance. To reduce the potential for disturbance, the majority of the opportunities for wildlife observation and photography and environmental interpretation to be provided under this alternative would be located around the perimeter of the Refuge rather than dispersed throughout the Refuge. Proposed observation sites and interpretive areas have been sited away from locations that support an abundance of migratory bird foraging and loafing; therefore, disturbance from human activity in the vicinity of most interpretive elements is expected to be minimal.

The interpretive trail proposed for the perimeter of Pond 28 could result in some disturbance to foraging and loafing birds during low tide, however, the level of use on this trail is not expected to be high, therefore, any adverse effects to shorebirds and other waterfowl is not expected to be significant. To ensure that disturbance impacts are minimal, use of the trail would be monitored periodically during fall and spring migration. If disturbance levels are found to be higher than anticipated, use of the trail would be regulated in a manner that would reduce disturbance to an acceptable level. Various approaches could include closing the trail during fall and spring migration, closing the trail during low tide, or only permitting trail use on weekends. The specific approach would be determined based on the level of disturbance identified.

The potential effects of designating and constructing the Otay Valley Regional Trail within the Refuge would be the same as those described in Alternative C.

#### **4.4.2.4.2 Effects to Fish**

##### **Habitat and Wildlife Management/Public Use**

The Refuge operation activities and public uses proposed under this alternative would provide no new benefits or result in any adverse effects to fish populations within the Refuge.

##### **Habitat Enhancement and Restoration**

The potential adverse and beneficial effects to the fish as a result of restoring the Otay River floodplain under this alternative would be the same as those described for Alternative C.

Pond breaching under this alternative would result in a maximum salinity of approximately 120 ppt in the South Bay during the first ebb tide. Increased salinities would generally be contained from the Chula Vista Wildlife Reserve south and would range from about 50 ppt in the area immediately to the west of the Reserve to 120 ppt to the southwest of the Reserve. The salinities in this area would vary with the tides and would be reduced with the high tide. The maximum salinities would decrease to approximately 60 ppt one day after breaching. The short-term effect of extreme salinities on the fish population in the South Bay could be the loss of some eggs, larvae, and/or young of the year and possibly the loss of some adult fish. More likely, this fluctuation in salinity levels would displace some species of fish for several days until salinities in the South Bay stabilize. The potential for some loss of fish and the temporary displacement of other fish would have no significant long-term adverse effects on fish diversity or abundance within the Bay. Restoring approximately 650 acres of intertidal habitat within the salt pond complex would however provide significant long-term benefits to fish populations within the Refuge and throughout the South Bay.

The incidental loss of fish that currently occurs when fish are trapped within the solar salt ponds would not occur once commercial salt production ceases on the Refuge; however, as bay water is drawn into the managed water ponds within the restored salt works, some fish would probably become trapped within the ponds. The salinities in these ponds are not expected to be high enough to result in fish mortality, but trapped fish could become easy prey for fish eating birds. A few fish could also be introduced into the brine management area as a result of transferring water from the managed ponds into these higher salinity ponds. It is unlikely that any fish could survive in these hypersaline ponds. To reduce the potential for fish loss within the managed water areas, fish screens would be installed at the initial bay water intake point in an effort to keep fish out of the managed water areas. The implementation of this measure would reduce potentially significant adverse effects to fish to below a level of significance.

#### **4.4.2.4.3 Effects to Invertebrates**

##### **Habitat and Wildlife Management/Public Use**

The management and public use proposals included under this alternative would not result in any significant adverse or beneficial effects to invertebrates occurring on the Refuge.

##### **Habitat Restoration**

The potential adverse and beneficial effects to invertebrates as a result of restoring the Otay River floodplain under this alternative would be the same as those described for Alternative C.

Pond breaching under this alternative would result in a maximum salinity of approximately 120 ppt in the South Bay during the first ebb tide. The salinities in this area would vary with the tides and would be reduced with the high tide. The maximum salinities would decrease to approximately 60 ppt one day after breaching. The short-term effect of extreme salinities on marine and estuarine invertebrates could be the loss of adult organisms, eggs, or larvae in those areas where salinity levels are the highest. Although some loss of invertebrate populations could occur, the effect would be temporary and recolonization would be expected to occur almost immediately after the salinity levels return to normal. Therefore, no adverse effects to the overall population levels of invertebrates within the bay would be expected. The benefits to marine and estuarine invertebrates as a result of breaching the salt ponds would be similar to those described under Alternative C, however, under this alternative, additional habitat would be available for the reintroduction of these species into the south end of the Bay. Many of the ponds that are too high to be restored to tidal action would be maintained as managed water areas in which bay water would be circulated through the ponds and water levels would be manipulated as appropriate throughout the year to support waterfowl, shorebirds, and other water birds. The primary intent of this component of the restoration proposal is to provide additional habitat for benthic invertebrates, which would in turn provide additional foraging habitat for migratory birds. Although many of the benthic invertebrates that become established within these ponds would be preyed upon by migratory birds, there would still be a moderate benefit to these organisms from the new habitat provided within the managed bay water ponds. The hypersaline ponds of the brine management area however would continue to provide limited if any habitat for marine and estuarine invertebrates.

As a result of restoring tidal influence to the ponds within the upper end of the primary pond system, as well as within much of the secondary pond system, the total biomass of brine invertebrates currently supported within the salt pond system would be greatly reduced. To minimize potential adverse effects associated with the elimination of brine invertebrate production within the restored system, approximately 45 acres of managed pond area would be maintained at salinity levels appropriate for brine invertebrate production. The indirect effects of reducing the availability of brine invertebrates on avian species were addressed previously in Section 4.4.2.3.1.

#### **4.4.2.4.4 Effects to Amphibians and Reptiles**

##### **Habitat and Wildlife Management/Public Use**

No effects to these organisms would be expected as a result of implementing the management activities and public uses proposed under this alternative.

##### **Habitat Restoration**

Restoration of the salt works would have no effect on these organisms. The potential effects of restoring the Otay River floodplain on amphibians and reptiles would be the same as those described for Alternative C.

#### **4.4.2.4.5 Effects to Mammals**

##### **Habitat and Wildlife Management/Public Use**

With the exception of predator management, which is addressed under Sweetwater Marsh Unit, Alternative A, the management activities and public uses proposed under this alternative would result in any adverse or beneficial effects to these organisms.

### **Habitat Restoration**

No effects to mammals would result from restoring the salt ponds and the effects of restoring the Otay River floodplain would be the same as those described in Alternative C.

## **4.5 Effects to Endangered and Threatened Species**

The direct, indirect, and cumulative effects to endangered and threatened species as a result of implementing the various alternatives are described below. An adverse effect to endangered and threatened species would be considered significant if:

- An action would result in the direct mortality or habitat loss, lowered reproductive success, or habitat fragmentation of a federally or state listed plant species.
- Permanent loss of occupied listed species habitat, substantial loss of foraging or nesting habitat for a listed species, or the direct mortality of individuals of a listed species would occur as a result of a proposed action.

An indirect beneficial impact would occur if an action would result in the creation of substantial new areas of foraging, roosting, or nesting habitat for listed wildlife species, or substantial new areas of habitat appropriate to support listed plant species. A significant cumulative impact would result from habitat modifications effecting listed species that would be considered minor for the proposed action but would be significant when considered in light of other similar losses within the region.

### **4.5.1 Sweetwater Marsh Unit**

#### **4.5.1.1 Alternative A – No Action**

##### **Habitat and Wildlife Management/Public Use Program**

The continuation of current management activities including predator management, as described in Section 4.4.1.1, would provide significant benefits to the Refuge's endangered and threatened species by maintaining the quality of the existing habitats and reducing the loss of these species to mammalian and avian predators. Benefits would result from annual nest site preparation at the D Street Fill to optimize nesting conditions for the California least tern and western snowy plover; monitoring of terns and plovers during the nesting season; and predator management to protect least tern, snowy plover and light-footed clapper rail adults, chicks, and eggs. Nest site preparation would involve vegetation management in the form of site disking and examination and, where necessary, repair of existing fencing and regulatory signage prior to the nesting season. No impacts to endangered species would result from this activity as it occurs in advance of the first observations of terns or plovers to the site.

Endangered species monitoring would also continue as described previously. Temporary disturbances to nesting birds could occur during monitoring (refer to Section 4.4.1.1); however, monitoring protocols are implemented to reduce the potential for such adverse effects. As a result, the benefits of the data provided as a result of monitoring outweigh the minor temporary adverse effects that occur during monitoring. In addition, on-site monitoring facilitates timely adaptive management (e.g. predator management, prosecution of trespassers, etc.) (*Patton 2002*). If during monitoring it is determined that disturbance impacts are becoming a threat to the nesting birds, the existing protocols would be reevaluated and additional measures such as greater use of blinds; further limiting the time spent in the colony; and/or scheduling monitoring activities to avoid

periods of increased disturbance from other sources, such as adverse weather conditions or the presence of potential predators, would be implemented.

The depredation of California least terns by mammalian and avian predators was the primary limiting factor to the reproductive success of this species throughout its range in 2000, with 19 species documented preying on least terns during that year (*Patton 2002*). At the D Street Fill, six species were considered possible predators in 2000; one of these, a northern harrier, was observed preying on tern chicks. Northern harriers were also observed preying on tern chicks in 2001 and on an adult tern in 2002. Other losses of chicks and eggs have been documented that are attributed to predation; however, the responsible species was not identified. The implementation of predator management is intended to reduce the adverse effects of predation and increase the reproductive success of this species and the western snowy plover, which suffers similar effects from predation.

Restoration of mitigation leasehold overlay on the D Street Fill by the leaseholder or cooperating third party could also benefit the endangered light-footed clapper rail by providing additional foraging and nesting habitat to support this species. Restoration of the upland areas on Gunpowder Point could benefit the threatened California gnatcatcher by providing habitat known to support the foraging and nesting requirements of this species.

Continuing to implement the current public use program on this Refuge Unit could result in occasional inadvertent or deliberate off-trail activity. Such activity could have an adverse effect on salt marsh bird's beak, which occurs in the drier upper marsh elevations that are more likely to be impacted by unauthorized pedestrian access. Field observations indicate that even a moderate amount of foot traffic can damage the fragile seedlings (*USFWS 1985*), resulting in decreased population numbers. Under this alternative, no changes to the existing trail system are proposed; therefore, the potential remains for some direct impacts to this species.

#### **4.5.1.2 Alternative B – Habitat Enhancement/Implementation** **Habitat and Wildlife Management/Public Use Program**

The beneficial effects to endangered and threatened species as a result of the predator management activities proposed under this alternative would be the same as those described under Alternative A. In addition, this alternative proposes to expand the marsh management activities currently occurring on the Refuge to include expanded invasive species control and increased enforcement of unauthorized access into the marsh. These actions are expected to improve habitat quality for the Refuge's population of salt marsh bird's beak.

This alternative includes no proposals to increase the number of uses occurring on the Refuge, nor does it propose the expansion of any current uses. Therefore, no new beneficial or adverse effects related to public use would occur under this alternative. The potential for impacts to salt marsh bird's beak from off-trail activities related to the use of the existing trail system on Gunpowder Point, as described for Alternative A, would also be realized under this alternative.

#### **Habitat Enhancement**

The enhancement actions proposed under this alternative would provide some improvements to the quality of the nesting habitat for the California least tern and western

snowy plover on the D Street Fill. The quality of foraging habitat for the light-footed clapper rail within the marsh complex would also be improved. Specifically, the actions proposed to improve tidal circulation within the marsh complex would indirectly benefit the light-footed clapper rail as channel sedimentation would decrease and, in some cases, be reversed to improve conditions for the establishment of cordgrass.

The potential for adverse effects to endangered and threatened species during grading would be avoided by controlling the level of construction activity permitted in the vicinity of active nest areas, including restricting some activities to the non-breeding season; establishing construction boundaries that minimize impacts to native vegetation and sensitive habitat areas; and monitoring sensitive habitat areas located adjacent to construction activity to assess actual disturbance levels and, where necessary, develop and implement additional protective measures.

#### **4.5.1.3 Alternative C –Habitat Restoration/Enhance Public Use (Preferred Alternative)**

##### **Habitat and Wildlife Management/Public Use Program**

Salt marsh bird's beak would benefit from the further expansion of management actions included under this alternative to improve propagation of this species on the Refuge. In addition, the proposal to redesign the existing trail system would provide opportunities for reducing potential impacts to this species from unauthorized off-trail activities.

##### **Habitat Restoration**

Because the habitat enhancements proposed under Alternative B would also be implemented under Alternative C, many of the benefits to endangered and threatened species described in Alternative B would also be realized under Alternative C. The potential adverse effects to these species during implementation of these enhancements would be minimized as described in Alternative B.

Under this alternative, the California least tern and western snowy plover would benefit by the proposal to retain approximately 10 more acres of the D Street Fill for nesting area than is proposed under the current MOU for the mitigation leasehold overlays (refer to Section 2.2.2.1). Specifically, under this alternative, approximately 13 acres of the D Street Fill would be restored to intertidal habitat and 33 acres within the Refuge would be maintained as nesting habitat. An additional 12 acres of the D Street Fill located on the adjacent Port property is also maintained as nesting habitat, resulting in the preservation of 45 acres of nesting habitat on the D Street Fill. This acreage is equivalent to the size of the historic nesting area (44 acres) identified in the Biological Opinion for the Combined Sweetwater River Flood Control and Highway Project (USFWS 1988b). Therefore, the restoration of the eastern end (approximately 13 acres) of the D Street Fill would not adversely affect the number of historic nesting acres in this area. The intent of this proposal is to increase the size and productivity of the least tern colony on this site, as well as improve conditions to support western snowy plover nesting, which has not occurred here since 2000.

As indicated in Figure 3-13, during the years between 1998 and 2005, least tern nesting has been confined to approximately 10 acres within the western portion of the D Street Fill and available data regarding past western snowy plover nesting at this location indicates that plover nests occurred within the same general area. The current configuration of the nesting area may relate to substrate conditions, proximity to human and mammalian activity, effects of night lighting from adjacent development, and/or distance to appropriate

foraging areas. In an effort to expand the use of the D Street Fill by nesting terns and plovers, this alternative proposes to enhance the existing substrate where necessary, provide additional fencing to keep out humans and potential predators, remove shrubs and other vegetation as appropriate to eliminate perching sites and provide open views of the surrounding area, and improve access to adjacent foraging areas. Providing accessible foraging areas in proximity to nesting site would benefit both species, but particularly the western snowy plover.

The implementation of the enhancement and restoration proposals for the D Street Fill would benefit several listed species, including the California least tern, western snowy plover, and the light-footed clapper rail, which would have access to the 13 acres of restored intertidal habitat on the eastern edge of the fill. Monitoring of the area prior to, during, and following implementation of these proposals would provide the data necessary to evaluate the success of the proposals and to verify that project objectives are being met. No adverse effects to any of these species are anticipated. It should also be noted that although 13 acres of upland habitat would be converted to wetland habitat within the Sweetwater Marsh Unit under this alternative, this loss would be more than offset within the South San Diego Bay Unit where between 18 and 36 acres of new nesting habitat would be created.

#### **4.5.2 South San Diego Bay Unit**

##### **4.5.2.1 Alternative A – No Action**

###### **Habitat and Wildlife Management/Public Use Program**

The continuation of current management activities, as proposed under the No Action Alternative, would provide no new benefits and result in no adverse effects to the endangered and threatened species supported on the Refuge. However, the implementation of nesting and foraging enhancements, as required in the Cooperative Agreement between the Port and the Service, would provide benefits to the endangered California least tern by improving nesting conditions along the salt pond levees and providing additional foraging opportunities in proximity to these improved nesting areas.

The implementation of least tern and snowy plover monitoring during the nesting season would result in effects similar to those described for monitoring under Sweetwater Marsh Unit, Alternative A. The No Action Alternative also proposes to implement the predator management activities described in Alternative A for the Sweetwater Marsh Unit to protect the endangered California least tern and light-footed clapper rail and the threatened western snowy plover. In 2000, 12 species were identified as possible predators of least terns at the salt works. Of the 12, five species were documented as preying on eggs, chicks, and/or adult least terns. Twenty-one eggs, one chick, and 13 nests were documented as lost to predation, although the species responsible for predation could not always be identified. Predator management provides benefits to the least tern and snowy plover by reducing the loss of chicks and eggs to mammalian and most avian predators and increasing the potential for reproductive success.

The current predator management plan does not include a proposal to address the loss of terns and plovers that result from predation by gull-billed terns, which also nest at the salt works. Therefore, adverse effects to these species as a result of gull-billed tern predation would continue. The Refuge Manager would continue to work with the Service's Migratory Birds Program to address issues related to gull-billed tern predation of listed species.



Under all of the alternatives proposed for the South San Diego Bay Unit, the California brown pelican would be expected to benefit from the continued maintenance of isolated roosting habitat within the Refuge. This roosting habitat includes the levee between Ponds 10 and 11 and a floating platform that has been installed within the salt works. The floating platform was installed to provide an additional isolated night roosting area for pelicans. Monitoring is currently being conducted to determine the actual use of the platform by pelicans. If monitoring results demonstrate positive benefits to the pelican, up to two additional floating platforms could be installed within appropriate salt ponds. Increasing the availability of isolated roosting areas for the pelican within the bay is expected to benefit this endangered species by reducing the travel distance between prey sites and roost sites, as well as reducing human and mammalian disturbance. This proposal, which would contribute to the increased availability, quality, and capacity of stopover sites within the flyway, could also positively influence the energy associated with migration. The placement of these platforms within various salt ponds, which was previously reviewed in accordance with NEPA, is not expected to adversely affect the nesting or foraging activities of the other endangered or threatened species found on the Refuge.

Boating and fishing within the open waters of the South San Diego Bay Unit could result in disturbance related impacts to the endangered California brown pelican and the threatened Pacific green sea turtle. An additional impact associated with fishing results of the inappropriate discarding of fishing line into the bay. Entanglement with fishing line results in death of many birds in the South San Diego Bay, as documented by Service field staff. Species affected include the California brown pelican, California least tern and western snowy plover. Boat propellers could also pose a hazard to turtles that happen to surface in path of oncoming boats. Stinson (1984) noted that turtles do not increase their speed when followed by a boat and have been observed to surface within six feet of a boat even when the motor was running. Enforcement of the 5 mph speed limit in this area would reduce the potential for impacts to turtles from boating activity.

Occasional guided tours on the salt works are not expected to result in any adverse impacts to listed species because tours would not be conducted during the nesting season. In addition, to protect wintering snowy plovers, all tours would be supervised to ensure that inappropriate access onto sensitive habitat areas would not occur.

#### **4.5.2.2 Alternative B –Enhance Nesting Habitat** **Habitat and Wildlife Management/Public Use Program**

The effects of implementing predator management and maintaining pelican roosting areas under this alternative would be the same as those described for Alternative A. The management actions proposed under this alternative would provide no new benefits for the light-footed clapper rail, but could reduce disturbance to the California brown pelican and green sea turtle as a result of increased enforcement of the established speed limit within the Refuge's open water areas. Losses and/or injuries to terns, plovers, and pelicans caused by entanglement in discarded fishing line could be reduced through proposed implementation of an outreach program intended to reduce the accumulation of discarded fishing line within the South Bay.

The potential for adverse effects from boating and fishing on the bay, which would continue to be permitted within the Refuge under this alternative, would be the same as those described under Alternative A. No new uses are proposed under this alternative.

### **Habitat Enhancement**

Although nesting enhancements (e.g. nesting substrate enhancement, creation of new nesting areas) are intended to increase California least tern and western snowy plover fledging success, these enhancements would also benefit colonial nesting seabirds and other birds that nest within the salt pond complex. During final restoration design, consideration would be given to designing new nesting areas in a manner that would not result in adverse effects to least terns or snowy plovers due to increases in the numbers of other nesting seabirds in a given nesting site. Potential impacts to snowy plovers as a result of increases in the numbers of nesting seabirds are not anticipated as plovers tend to utilize different microhabitats and, with the exception of gull-billed tern predation pressures on newly hatched plover chicks, generally do not face conflicts with seabirds except in the case of needing space for nesting. The provision of an additional 18 acres of nesting habitat is expected to reduce overcrowding and provide alternative nesting options for plovers and terns, which are currently nesting on marginal sites near the eastern end of the salt pond complex.

In addition to providing new nesting areas, these enhancement proposals would also result in the recontouring the levee slopes to provide young plover chicks with easier access to the edge of the salt ponds, thus enhancing their foraging opportunities. Additional nesting opportunities are also proposed for plovers through the management of the water level within Pond 20 or another appropriate pond within the system. Under this proposal, water levels in the pond would be lowered during the nesting season to provide plovers with dry areas suitable for nesting. These actions in combination with ongoing predator management could provide potentially significant cumulative benefits in terms improved fledging success for snowy plovers.

A potential adverse effect to California least terns and western snowy plovers resulting from the implementation of nesting enhancements within the Refuge is the potential benefit these enhancements could have on the Refuge's gull-billed tern breeding population. An increase in gull-billed tern nesting numbers may adversely affect productivity for both the western snowy plover and the California least tern at any site within San Diego Bay, including sites managed by the Navy, and within the Tijuana Estuary wetland complex. In the last few seasons, the tendency has been for plover fledglings to only be observed after the gull-billed terns have abandoned the site for the season. This is occurring at current population levels for all three species. To address this situation, gull-billed tern nesting and foraging activities would continue to be monitored at the salt works and any changes in the current conditions would be noted and evaluated in consultation with the Service's Migratory Birds Program.

No new benefits to the light-footed clapper rail would be realized under this alternative, as it lacks any proposals to restore cordgrass-dominated salt marsh habitat.

#### **4.5.2.3 Alternative C – Enhance and Restore Habitat/Expand Public Uses Habitat and Wildlife Management/Public Use Program**

The benefits of predator management to the California least tern, western snowy plover, and light-footed clapper and the benefits to pelicans from the maintenance of roosting platforms would be the same as described previously. No adverse effects to endangered or threatened species are expected as the result of implementing any of the other management activities proposed under this alternative.

Boating and fishing on the bay would also continue to be permitted under this alternative, therefore, the impacts to listed species from these uses, as described for Alternative A, would also occur under this alternative. Opening the northern levee of Pond 11 to public access for fishing and wildlife observation would increase human activity in proximity to existing and proposed light-footed clapper rail habitat. The major threat to light-footed clapper rails from this increase in human activity involves the potential for direct habitat or nest losses through trampling of cordgrass or pickleweed where nests could occur. Clapper rails are not as prone to reacting to the presence of humans in the vicinity of their habitat as are other bird species; however, foraging opportunities may be disrupted if humans are present for long periods in clapper rail territories. Frequent disturbance could cause the rails to abandon the area in search of more suitable habitat. The level of impact to this species as a result of this proposal would depend upon the final design of the fishing and wildlife observation facilities that are provided, as well as the measures that are incorporated into the design to minimize such impacts.

The State listed endangered Belding's savannah sparrow occupies the high marsh habitat that occurs along the slopes of the Pond 11 levee, as well as in the adjacent South Bay Biological Study Area. The quality of this habitat could be reduced as a result of direct loss of vegetation through trampling, as well as by frequent disturbance to the birds. Trash and discarded fishing line also represent a threat to these species.

Appropriate siting of environmental education activities outside of sensitive areas and adequate Refuge oversight and supervision of these activities would avoid any potential for adverse effects to listed species. Interpretive elements proposed along the Bayshore Bikeway would occur outside of the boundaries of the marsh; therefore, the potential for impacts to clapper rails and other listed species would be minimal. Regular guided tours of the salt works area would not be expected to result in any adverse impacts to listed species because tours would not be conducted during the nesting season. Adverse impacts to clapper rails as a result of the extension of the Otay Valley Regional Trail along the eastern perimeter of the Refuge would be minimized through appropriate fencing and signage.

#### **Habitat Enhancement and Restoration**

The nesting enhancements proposed for Alternative B would also be implemented under this alternative; therefore, similar benefits to the California least tern and western snowy plover, as described under Alternative B, would also occur under Alternative C.

The restoration proposals included in this alternative would substantially expand the total acreage of suitable habitat for the light-footed clapper rail in the South Bay. The restoration of up to 325 acres of cordgrass-dominated salt marsh habitat within the Refuge including approximately 25 acres within the Otay River Floodplain and up to 300 acres within the restored salt ponds is expected to provide significant benefits for this species. Foraging opportunities for the California least tern would also be improved as a result of the salt marsh restoration proposals included under this alternative.

Proposed improvements in the quantity and quality of freshwater wetland habitat within the Otay River floodplain could also benefit the endangered least Bell's vireo and southwestern willow flycatcher by providing new nesting opportunities for these species, which although observed upstream within the Otay River drainage, are not currently supported on the Refuge.

The potential for adverse effects to the Refuge's endangered and threatened species during restoration-related grading activities would be minimized by controlling the level of construction activity permitted in the vicinity of active nest areas, including restricting some activities to the non-breeding season; establishing construction boundaries that minimize impacts to native vegetation and sensitive habitat areas; and monitoring sensitive habitat areas during construction to assess actual disturbance levels and, where necessary, develop and implement additional protective measures. Removing individual rails from the area and maintaining them at an appropriate facility until they can be safely released back into the restored habitat would avoid direct impacts to the light-footed clapper rail as a result of implementing restoration activities in the Otay River floodplain.

#### **4.5.2.4 Alternative D - Maximize Habitat Restoration/Moderately Increase Public Uses (Preferred Alternative)**

##### **Habitat and Wildlife Management/Public Use Program**

Benefits to the California least tern, western snowy plover, and light-footed clapper rail from predator management would be the same as described previously. Pelican roosting platforms would continue to be maintained on the Refuge, but may be moved from the salt ponds to the open bay. In addition, Refuge management activities would be expanded under this alternative to ensure the continued isolation of the salt pond levees following the closing of the commercial solar salt operation. Activities would include the installation of perimeter fencing around the eastern end of the salt ponds and an increased presence of Refuge personnel at the site. These actions would minimize increases in unauthorized access onto the salt ponds and reduce the potential for human disturbance that could adversely affect sensitive species. No adverse effects to endangered or threatened species are expected as the result of implementing any of the management activities proposed under this alternative.

The northern levee of Pond 11 would not be opened under this alternative; therefore, the potential adverse effects of opening the levee would be avoided under this alternative. The effects of conducting regular tours of the salt works, extending the Otay Valley Regional Trail onto the Refuge, and creating an environmental education program would be the same as those described in Alternative C. The development of an interpretive program and wildlife observation areas along the perimeter of the Refuge would be adequately separated from habitats that support listed species; therefore, no impacts related to human disturbance are anticipated. Fencing around observation areas at the south end of the Refuge would be designed to avoid the creation of perching sites that could be used by potential avian predators.

##### **Habitat Enhancement and Restoration**

All of the benefits to endangered and threatened species described in Alternative C would also be realized under Alternative D, with potentially greater benefits to the light-footed clapper rail as the result of additional restoration of habitat known to support this species.

Additionally, under Alternative D, nesting enhancements would occur in association with the restoration of tidal influence within many of the ponds. This would reduce the distance between nesting areas and foraging areas for both species. To ensure that plovers have easy access to foraging areas, the final restoration plans would be designed to address the foraging needs of plover chicks and adults and would include guidance to ensure that this access is maintained over time. Currently, access to foraging areas within the salt ponds for plovers is limited in many areas due to steep slopes and lack of adequate shoreline

adjacent to nesting areas. This may be one reason for the low numbers of nesting plovers within the salt works. Improved access to foraging areas would represent a benefit to both species and is intended to result in an increase in the number of least tern and snowy plover nests established each year within the South San Diego Bay Unit. Other measures, such as enhanced nesting substrate and additional fencing and signage to control unauthorized use are proposed to increase fledging success.

The measure described under Alternative C to avoid or minimize impacts to endangered and threatened species during restoration would also be implemented under this alternative.

## **4.6 Effects to Cultural Resources**

The National Historic Preservation Act (NHPA) of 1966, as amended, establishes the federal government's policy on historic preservation and the programs through which that policy is implemented. Relevant policies on historic preservation and associated programs, including the National Register of Historic Places (NRHP), were described previously in Section 3.5. According to the NHPA, historic properties include "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places" (16 USC 470w (5)). The criteria used to evaluate eligibility are presented in Section 3.5 of this document.

Section 106 (16 USC 470f) of the NHPA requires federal agencies, prior to taking action, to take into account the effects of their undertaking on historic properties. Specific regulations regarding compliance with Section 106 state that although the tasks necessary to comply with Section 106 may be delegated to others, the federal agency is ultimately responsible for ensuring that the Section 106 process is completed according to statute. The Section 106 process has four basic steps:

- Identify and evaluate historic properties;
- Assess adverse effects of the project on historic properties;
- Resolve any adverse effects of the project on historic properties in consultation with the SHPO/Tribal Historic Preservation Officer (THPO), and other interested parties, resulting in a Memorandum of Agreement (MOA); and
- Proceed in accordance with the MOA.

To determine if a proposed action could impact a cultural resource, it is necessary to conduct a survey of the Area of Potential Effects (APE) or if a survey has been previously conducted, to review the results of that survey and determine if any resources identified are eligible for inclusion in the NRHP. The APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties. It is not necessary to know that the area in question contains historic properties, or even to suspect that such properties exist, in order to determine the APE. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking. In addition, the APE is not always a contiguous area; there may be multiple alternative project sites or multiple areas in which changes are anticipated. The APE for the San Diego Bay CCP is illustrated in Figure 3-1. A number of actions are proposed to implement the CCP. Each action would have its own project specific APE. For example, the APE for the restoration of the salt works under Alternative C would include those ponds and associated levees proposed for restoration. If fill from the Otay River floodplain is required to implement the pond

restoration, the area of excavation and any construction routes or staging areas would also be included in the APE.

As described in Section 3.5, surveys have previously been conducted for various portions of the APE and cultural resources have been identified. Of the resources identified, some have been deemed ineligible for inclusion in the NRHP, while others are considered eligible. In addition, several known resources have yet to be evaluated. There are also areas within the APE that have yet to be surveyed to determine the presence or absence of cultural resources. Surveys of these areas and determinations of eligibility for any features that have not yet been evaluated would be required prior to the implementation of any ground-disturbing or other activities that may affect historic resources.

An impact to cultural resources would be considered significant if it adversely affects a resource listed in or eligible for listing in the NRHP. In general, an adverse effect may occur if a cultural resource would be physically damaged or altered, isolated from the context considered significant, affected by project elements that would be out of character with the significant property or its setting. Title 36 CFR Part 800 defines effects and adverse effects on historic resources as follows:

Section 800.5(1) Criteria of Adverse Effects. An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the NRHP. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

Section 800.5(2) Examples of Adverse Effects. Adverse effects on historic properties include, but are not limited to:

- (i) Physical destruction, damage, or alteration of all or part of the property;
- (ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines;
- (iii) Removal of the property from its historic location;
- (iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
- (v) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;
- (vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
- (vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

Cumulative impacts to cultural resources could result from individually minor but collectively significant actions taking place over a period of time. Cumulative effects often occur to districts,

where several minor changes to contributing properties, their landscaping, or to their setting over time could result in a significant loss of integrity (*City of San Diego 2004*).

#### **4.6.1 Sweetwater Marsh Unit**

##### **4.6.1.1 Effects Common to All Alternatives**

Several historic resources have been identified within the boundary of the Sweetwater Marsh Unit. Of these resources, all but one have been evaluated and determined to be ineligible for inclusion to the NRHP. One known resource, the Hercules Powder Company site that is located on Gunpowder Point, has not yet been evaluated. Because this resource has not yet been evaluated, measures would be implemented to maintain site integrity.

When a new project is proposed on the Sweetwater Marsh Unit that would involve earth moving or other ground disturbing activities, a review of the previous survey results would be conducted and consultation completed with SHPO and interested parties.

##### **4.6.1.2 Alternative A – No Action**

There is a potential for adverse effects to the Hercules Powder Company under existing conditions because of the proximity of the resource to public use areas. Post and cable fencing has been provided along both sides of the existing trail to reduce this potential for intentional or inadvertent impacts to site resources.

In addition, to raise awareness of the need to protect what remains of this site, interpretation of the site's history is provided on signs located along a portion of the trail.

No new management activities are proposed under Alternative A that could compromise the integrity of the Hercules Powder Plant site; however, there is the potential for habitat restoration on Gunpowder Point that may affect this resource. Gunpowder Point is one of several mitigation leasehold overlays that are currently available for restoration in accordance with the Settlement Agreement described in Section 2.2.2.1. To avoid adverse effects to cultural resources as a result of future restoration, a cultural resource survey would be conducted prior to implementing any restoration activities. Any new cultural resources identified during the survey, as well as the Hercules Powder Plant site, would be recorded and evaluated for eligibility to the NRHP. Once this work is completed, additional measures may be required depending upon the results of the eligibility determination. If any sites are determined to be eligible to the NRHP, the restoration plans would need to be assessed for potential effects to the historic property. If effects are possible, the proposal would be reviewed to ensure that the effects have the least impact to original materials and are in conformance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. Changes that comply with the Secretary's Standards would have no adverse affect on historic properties. Once an assessment has been completed, the findings would be forwarded to SHPO for concurrence. Where removal or major alteration of the property would occur, mitigation would be developed and stipulated in a Memorandum of Agreement (MOA) with SHPO and the Advisory Council on Historic Preservation. Other interested parties, such as the Chula Vista and/or San Diego Historical Society and the Save Our Heritage Organisation (SOHO), would likely be interested parties in this process and would be invited to participate in the MOA.

Although all of the previously recorded archaeological sites were determined to be ineligible, earth moving activities occurring in proximity to these sites would be monitored because of the potential for buried cultural material in these areas. If any cultural materials are uncovered during excavation, the Regional Historic Preservation Officer would be contacted to review the materials and recommend a treatment that is consistent with applicable laws and policies.



Implementation of the procedures described above is expected to avoid adverse effects to historic resources; however, additional analysis under NEPA may be required once specific details regarding the historic resources that could be affected and/or the specific actions to be implemented are available.

#### **4.6.1.3 Alternative B – Habitat Enhancement/Interpretation**

The potential effects to cultural resources described under Alternative A would also occur under Alternative B; therefore, the measures described above for determining and addressing adverse effects would also apply to Alternative B.

The enhancement projects proposed under this alternative (refer to Figure 2-3) would not be expected to have an adverse effect on historic resources. However, because portions of the area surrounding the old roadbed to the east of Gunpowder Point could contain buried cultural material, the excavation and removal of the old roadbed would be monitored. If any cultural materials are discovered, the Regional Historic Preservation Officer would be contacted to review the materials and recommend a treatment that is consistent with applicable laws and policies.

Implementation of the procedures described above is expected to mitigate any potential adverse effects to historic resources; however, additional analysis under NEPA may be required once specific details regarding the historic resources that could be affected and/or the specific actions to be implemented are available.

#### **4.6.1.4 Alternative C – Habitat Restoration/Enhance Public Use (Preferred Alternative)**

The actions described under Alternatives A and B would also be implemented under this alternative. In addition, the excavation associated with salt marsh restoration proposed along the northern edge of Gunpowder Point and upland restoration proposed on Gunpowder Point would be monitored because of the potential for buried cultural material. Any cultural material that is discovered would be handled in accordance with applicable laws and policies.

The redevelopment of the existing trail system on Gunpowder Point could have an adverse effect on the Hercules Powder Company site if the integrity of the site is impacted prior to recordation and determination of eligibility. To avoid this effect, the procedures described under Alternative A for recording the site, determining its eligibility to the NRHP, and evaluating effects to the resource should it be determined to be eligible would also be implemented under this Alternative.

Implementation of the procedures described above is expected to avoid any potential adverse effects to historic resources; however, additional analysis under NEPA may be required once specific details regarding the historic resources that could be affected and/or the specific actions to be implemented are available.

### **4.6.2 South San Diego Bay Unit**

#### **4.6.2.1 Effects Common to All Alternatives**

Historic resources have been identified within the boundary of the South San Diego Bay Unit including the “Western Salt Company Salt Works,” which was determined to be eligible for the NRHP in 2001. The designation is based on the high degree of integrity of the salt ponds as representative of the solar salt industry during the period from 1916 to 1949. Changes to the pond design, use, setting, or function would affect the significant characteristics that have been determined to be eligible to the NRHP. The effects to this historic property would differ depending upon which alternative is implemented, as described below.

Cultural resource surveys have also identified prehistoric archaeological sites along the bayfront shoreline and within the Otay River floodplain. The amount of activity and the importance of shell and marine resources to Native populations indicate that new site discoveries may occur within the boundaries of this Refuge Unit. A cultural resource survey would be conducted within the Otay River floodplain and along the southern edge of the salt ponds prior to initiating any actions that require excavation. All new sites and any previously recorded sites would be evaluated to determine eligibility to the NRHP prior to implementing actions that could affect these resources.

Eligible and potentially eligible resources could be directly affected by ground-disturbing activities associated with habitat enhancement and restoration, levee modifications, changes in the operation of the salt works, and facilities construction. Public access into areas that include cultural resources could also result in adverse effects to these resources.

#### **4.6.2.2 Alternative A – No Action**

No changes to the overall use, function, design, or setting of the salt works is proposed under this alternative. Some minor changes to the salt works could occur to facilitate the continuation of the salt operation or to facilitate on-going habitat management activities. Although these changes would affect the resource, they are relatively minor and would not be considered an adverse effect. This is because the primary character defining feature of the salt works is the functioning industrial landscape with each of the key steps in the solar salt process illustrated. Elements of the landscape that are clearly associated with the salt works operation are the continuously changing piles of salt near the processing plant, the division of the ponds, and the various levels of pond salinity and production. The minor changes that could occur under this alternative would not alter the relationship, configuration, design, and/or function of the salt works, and would not diminish the property's historic character. Such changes would meet the criteria finding for a No Adverse Effect. Further, only limited public access is currently permitted within the salt works and the Otay River floodplain; therefore, no adverse effects to cultural resources as a result of human activity within the Refuge Unit are anticipated.

Based on the criteria for assessing adverse effects that are provided in the NHPA, Alternative A is considered to be a "No Adverse Effect" undertaking as per 36 CFR Part 800.5(3)(b). The Service's determination of no adverse effect would be submitted to SHPO for concurrence. No mitigation would be required.

#### **4.6.2.3 Alternative B – Enhance Nesting Habitat**

This alternative proposes minor modifications to the salt pond levees to better accommodate nesting seabirds. In addition, new nesting areas would be provided within the salt works by adding limited areas of fill within some ponds. The function of the levees and ponds would remain unchanged and only minor changes in the appearance of the ponds and levee surfaces and side slopes would occur. Commercial solar salt production would continue and for the most part, the enhancements proposed for the levees would be no different in appearance than that which would result from periodic maintenance conducted in association with the existing solar salt operation. The minor modifications to historic properties proposed under this alternative would meet the criteria of finding for a "No Adverse Effect" undertaking as per 36 CFR Part 800.5(3)(b). The Service's determination of no adverse effect would be submitted to SHPO for concurrence. No mitigation would be required.

The potential effects to cultural resources within the Otay River floodplain would be the same as described under Alternative A.

#### **4.6.2.4 Alternative C – Enhance and Restore Habitat/Expand Public Use**

Alternative C proposes to restore native habitat within the Refuge Unit by excavating portions of the Otay River floodplain to restore coastal wetlands and breaching some salt ponds to restore intertidal habitat. Because of the potential for unknown buried cultural resources within the Otay River floodplain, excavation could affect cultural resources. Prior to any excavation, the area of potential effects would be surveyed and any cultural resources identified would be evaluated for eligibility to the NRHP. If effects to an eligible site are possible, the Service would consult with SHPO, federally recognized Tribes, and interested parties. To ensure that no unanticipated effects to cultural resources would occur during excavation, all excavation within the Otay River floodplain would be monitored to ensure that if cultural resources are present, they are treated appropriately. Also prior to excavation, the Service would work with Native American groups to create a Memorandum of Understanding (MOU) to implement the inadvertent discovery clause of the Native American Graves Protection and Repatriation Act (NAGPRA). Development of this MOU would involve identifying the Native American Tribes, Groups, and direct lineal descendants that may be affiliated with these Refuge lands, initiating consultation with the affiliated Tribes, Groups, and/or direct lineal descendants, developing procedures to follow for intentional and inadvertent discoveries, and identifying the persons to contact for the purposes of NAGPRA.

Under Alternative C, a minimum of 200 and a maximum of approximately 440 acres of salt ponds would be taken out of salt production and breached to restore intertidal habitat. The remaining ponds would continue to be used for solar salt production.

Reducing the number of salt ponds by 200 acres (Salt Works Restoration Option 1) would alter the historically intact landscape by eliminating the ponds on the west side of the Otay River. However, under this Restoration Option, a proper balance in the types of ponds representative of the solar salt making process would be retained on the east side of the Otay River and solar salt production would continue under a reduced footprint. Because the character defining features of the South Bay Salt Works include the landscape conformation of levees, ponds, water control structures, roads, and industrial buildings, the character of the salt operation would not be substantially altered by removing the western ponds from salt production. In addition, the overall configuration of the pond levees would be retained, although portions of the levees would be breached to permit tidal exchange within the ponds. Although this Restoration Option would alter a historic property, the historic character and function of the South Bay Salt Works solar salt system would be sustained. Therefore, the proposed modifications to this historic property would meet the criteria of finding for a “No Adverse Effect” (36 CFR Part 800.5(3)(b)). The Service’s determination of no adverse effect would be submitted to SHPO for concurrence. The proposed modification to the historic property would be reviewed by SHPO to ensure that the changes have the least impact to original materials and are in conformance with the *Secretary of the Interior’s Standards for the Treatment of Historic Properties*. If SHPO concurs that the changes comply with the *Secretary’s Standards*, no mitigation for project effects would be required.

Under Salt Works Restoration Option 2, nearly half the acres involved in salt production would be removed and it is not known if solar salt production would be economically viable within the reduced footprint. Therefore, the implementation of this option would result in a recognizable loss in the use and function of the ponds. Based on the criteria for assessing adverse effects that are provided in 36 CFR 800.5, changing the use of the salt pond would cause a change in the character of the property which contributes to its eligibility (36 CFR 800.5(2)(iv)). Additionally, removing the salt ponds from production would cause a loss of historic materials (36 CFR 800.5(2)(i)). Implementation of Alternative C, Salt Works Option 2 would therefore have an adverse effect on historic properties and mitigation would be required.

Mitigation would be developed and stipulated in a Memorandum of Agreement (MOA) with SHPO and the Advisory Council on Historic Preservation. Other interested parties, such as the Chula Vista and/or San Diego Historical Society and the Save Our Heritage Organisation (SOHO), would likely be interested parties in this process and would be invited to participate in the MOA. A possible mitigation strategy for the South Bay Salt Works would involve recordation through photographs and reprinting historic photographs and interpreting the recorded images for the public. The mitigation or treatment plan would be developed during consultation with SHPO and interested parties. An essential element of the treatment plan would include conveyance of a sense of the original design and function of the solar salt industry to the public.

This alternative also proposes extensive excavation of the Otay River floodplain. Prior to the completion of final restoration plans for this area, the area of potential effect would be identified and a survey of the area would be conducted to record all cultural resources. If cultural resources are identified, their eligibility for inclusion in the NRHP would be assessed, and, if necessary, a treatment plan for mitigating any adverse effects to eligible resources would be prepared. The assessment of project effects, treatment plan, and eligibility determinations would involve consultation with SHPO and other interested parties. If deemed appropriate, the proposed excavation would be monitored to ensure that no buried resources are uncovered during grading. Prior to excavation, Native American Tribes, Groups, and direct lineal descendants that may be affiliated would be identified and a Memorandum of Understanding with the appropriate Native American groups would be created to established procedures for implementing the inadvertent discovery clause of NAGPRA.

#### **4.6.2.5 Alternative D – Maximize Habitat Restoration/Moderately Increase Public Uses (Preferred Alternative)**

The implementation of Alternative D would result in the elimination of solar salt production within San Diego Bay. Changing the use of all of the salt ponds would cause a change in the character of the property which contributes to its eligibility as per 36 CFR 800.5(2)(iv) and removing all of the salt ponds from production would also cause a loss of historic material as per 800.5(2)(i). Therefore, elimination of the solar salt production in San Diego Bay would have an adverse effect on historic properties and would require mitigation similar to that described for Salt Works Restoration Option 2 under Alternative C.

The potential effects of this alternative on cultural resources located within the Otay River floodplain would be the same as those addressed under Alternative C.

## **4.7 Effects to the Social and Economic Environment**

### **4.7.1 Effects to Land Use**

This section analyzes the potential land use conflicts between the habitat management and public use proposals presented in each alternative and the existing and planned land uses in the immediate vicinity of the two Refuge Units.

Adverse effects related to land use would be considered significant if:

- Substantial incompatibility between proposed uses or activities and adjacent existing uses would occur.
- Substantial changes in use or the intensity of use are proposed, where the resulting activity or use pattern would create significant noise, traffic, public safety, or similar environment impacts that would adversely affect the existing or future the use of adjacent areas.

#### **4.7.1.1 Sweetwater Marsh Unit**

##### **4.7.1.1.1 Alternative A – No Action**

No potential land use conflicts to existing or planned uses in proximity to the Refuge are anticipated under Alternative A. Public uses would be maintained at current levels; therefore, no additional traffic would be generated and no increases in the current demand for parking in the area would occur. The majority of the Refuge would continue to be closed to public access; therefore, no disturbance to adjacent properties from human activity would be anticipated.

##### **4.7.1.1.2 Alternative B – Habitat Enhancement/Interpretation**

The expansion of current management activities to include improvements to tidal circulation within the marsh complex could result in short term disruptions in public access to the Nature Center, primarily during the installation of an additional culvert under the existing access road. Working with the Nature Center staff to schedule construction during historically slower times during the week would minimize this impact. No other land use conflicts are anticipated under this alternative.

##### **4.7.1.1.3 Alternative C –Habitat Restoration/Enhance Public Use (Preferred Alternative)**

The restoration proposals included under this alternative would not result in any conflicts to existing or future land uses in the vicinity of the Refuge. Habitat restoration on Gunpowder Point, as well as the redesign of the existing trail system, could result in some disruption to public access, temporarily interrupting visitor use of the trail. To minimize this effect, some level of trail access would be provided during restoration and new trail construction.

#### **4.7.1.2 South San Diego Bay Unit**

##### **4.7.1.2.1 Alternative A – No Action**

No potential land use conflicts are anticipated under this status quo alternative in regards to existing uses or uses that would be permitted in proximity to the Refuge. Nuisance effects to adjacent uses related to occasional odors generated from the salt ponds would continue (refer to Section 4.7.5.2). Public uses would be maintained at current levels; therefore, no additional traffic would be generated and no increases in the current demand for parking in the area would occur. The majority of the Refuge would continue to be closed to public access; therefore, no disturbance to adjacent properties from human activity would be anticipated.

##### **4.7.1.2.2 Alternative B - Enhance Nesting Habitat**

No land use conflicts would be expected as a result of implementing the nesting enhancement proposals included under this alternative; therefore, the conclusions presented for Alternative A would apply to this alternative as well.

##### **4.7.1.2.3 Alternative C - Enhance and Restore Habitat/Expand Public Use**

The implementation of this alternative would alter the existing use of the salt works by reducing the area currently managed for solar salt production. Under Salt Works Restoration Option 1, the size of the salt works operation within the Refuge would be reduced by approximately 185 acres and by 430 acres under Option 2. The effects of restoring a portion of the salt works on adjacent land uses, both existing and planned under currently adopted local land use plans, would most likely only be discernable to the property owners located adjacent to Pond 10A. Major changes would include the

construction of a low berm around the southern and eastern perimeter of the pond to prevent future inundation of the adjacent properties during extreme high tides and the introduction of tidal exchange within the pond that would result in more frequent and predictable fluctuations in the pond's water level. No land use conflicts are anticipated as a result of these changes. In addition, no public access would be permitted in the vicinity of Pond 10A; therefore, conflicts between existing residential uses and increased human activity are not expected.

Under either restoration scenario for the salt works, detailed restoration planning involving Pond 11 would require coordination with the Navy, which owns the northwest corner of the pond, to determine what if any changes in pond elevation would be appropriate and/or acceptable in this location.

Navy SEALs transit through the boat channel north of Emory Cove and use Emory Cove to access Navy lands and established training areas at NRRF. A portion of these submerged lands are leased to the Service by the State Lands Commission as part of the South San Diego Bay Unit. No management actions are proposed for the Refuge on submerged lands north of and adjacent to Emory Cove that would restrict Navy access to NRRF or their ability to train at NRRF.

To avoid potential conflicts between the restoration proposals for the Otay River floodplain and the existing public facilities in this area that are maintained by the City of San Diego, the development of final restoration plans would be coordinated with the affected departments of the City of San Diego. No conflicts with other adjacent property owners are anticipated.

The eastern most portion of the Refuge is included within the boundaries of the Otay Valley Regional Park planning area. The proposal to restore this area to native upland and coastal wetland habitat would not conflict with the goals of this plan. Further, the proposal to accommodate the Otay Valley Regional Trail along the eastern perimeter of the Refuge would facilitate the Park's goal of developing an east/west regional trail through the entire length of the park.

Opening the northern levee of Pond 11 to public access could result in conflicts with existing uses on the adjacent County Biological Study Area and, to a lesser extent, with the Bayshore Bikeway. These conflicts would relate to increases in the demand for parking, as visitors to the Refuge would park in the County's parking lot, as well as increases in pedestrian traffic on and in the vicinity of the bike path. Additional analysis of these potential conflicts would occur in association with a future step-down plan for this area. Further, this proposal would require coordination with the Navy, which owns the western end of the levee. Such coordination would occur during step down planning.

#### **4.7.1.2.4 Alternative D - Maximize Habitat Restoration/Moderately Increase Public Uses (Preferred Alternative)**

Maximum restoration of the salt ponds would result in the elimination of the commercial solar salt operation from the Refuge. The effects to surrounding land uses of restoring the salt ponds and the land use effects of restoring the Otay River floodplain would be the same as those described for Alternative C.

The potential conflicts associated with opening the northern levee of Pond 11 would not occur under this alternative; however facilitation of regional trail planning, as described under Alternative C, would also be proposed under this alternative.

The development of environmental education and interpretation programs to be implemented around the perimeter of the Refuge would not be expected to result in any land use conflicts.

#### **4.7.2 Effects to Traffic Circulation and Parking**

This section presents the estimated level of traffic that could be generated by the construction/restoration activities associated with the various alternatives, as well as the public uses proposed under each alternative. Also included in this section is an analysis of the potential effects of increased traffic on local and regional traffic circulation and an analysis of the effects that an increased demand for parking could have on the surrounding area.

Adverse effects related to traffic would be considered significant if:

- Project-related traffic would exceed accepted increases in roadway volume to capacity ratios as established by the affected jurisdictions.
- Road capacities were exceeded as a result of proposed actions
- Sight distance provided at ingress/egress points is inadequate.
- A proposed action would substantially increase the demand for on- and/or off-street parking spaces.

##### **4.7.2.1 Sweetwater Marsh Unit**

###### **4.7.2.1.1 Alternative A – No Action**

Maintaining the current level of management activities and public uses on the Refuge would not result in any new trip generation, nor would the demand for parking increase; therefore, this alternative would not adversely affect traffic circulation or parking availability in the vicinity of the Refuge.

Implementation of restoration projects on the mitigation leasehold overlays would generate construction related traffic. Although no significant adverse affects to traffic circulation are anticipated, the number of trips to be generated and the potential for impacts to local and regional traffic circulation would be evaluated at the time that specific restoration plans are developed for these sites.

###### **4.7.2.1.2 Alternative B – Habitat Enhancement/Interpretation**

The management activities proposed under this alternative would not result in any measurable increases in traffic and no new public uses are proposed under this alternative; therefore, no adverse affects to the surrounding local or regional transportation system would result from the implementation of this alternative. Short-term increases in truck traffic could occur if restoration is implemented on the mitigation leasehold overlays. The effects of these increases in traffic would be evaluated once site-specific restoration plans are developed for one or more of the overlays.



Improving tidal circulation in the marsh complex would result in short-term, limited increases in traffic as construction vehicles and crews would travel to and from the Refuge while the various improvements are being completed. The number of trips that would be generated during construction cannot be determined until specific grading plans are developed and the total volume of material to be removed from the site is known. However, because the projects are relatively small, any increase in traffic would be limited in terms of both duration (a few weeks to a few months) and number of trips generated. To minimize the effects of the additional construction traffic on the surrounding circulation system, truck traffic would be restricted to off-peak traffic hours to avoid conflicts with peak congestion periods on local streets and I-5. The number of short-term trips to be generated is not expected to impact the current level of service on the surrounding surface streets or on the freeway system; therefore, no adverse effects to local or regional traffic circulation are anticipated.

#### **4.7.2.1.3 Alternative C –Habitat Restoration/Enhance Public Use (Preferred Alternative)**

The restoration activities included under Alternative C would result in short term increases in traffic as construction vehicles and crews travel to and from this Refuge Unit during project implementation. In addition, the excavation required to restore portions of the Refuge to native habitat would likely involve the export of excess material from the site, resulting in short-term increases in truck traffic on adjacent roadways and I-5. The total number of trips to be generated would be evaluated at the time that specific restoration plans are developed for these areas. To avoid adverse direct and cumulative impacts related to traffic congestion during peak traffic periods, truck trips to and from the site would be limited to off-peak hours. Additional measures to reduce adverse traffic impacts, such as a traffic control plan, may be developed once site-specific restoration plans are completed and more precise information regarding anticipated grading volumes become available.

The expansion of the public use programs would result in some permanent increases in traffic generation, as well as some increases in parking demand at the Chula Vista Nature Center parking lot located at the end of E Street. Expanded environmental education programs would result in increases in the number of school buses traveling to and from the Refuge, with little or no private vehicle trips generated. Additional car trips would be generated as a result of improved opportunities for wildlife observation and environmental interpretation; however these new trips would be generated during off-peak traffic periods. The number of trips generated from these activities is expected to be well below 5% of the current traffic volumes on the surrounding local streets and the effect on the total traffic volumes on I-5 as a result of expanding these uses would be minimal. Adequate parking is currently available in the Chula Vista Nature Center parking lot to accommodate increased visitation to the Refuge during normal hours of operation; therefore, expanding the public use programs would have no adverse affect on the availability of parking in the vicinity of the Refuge.

### **4.7.2.2 South San Diego Bay Unit**

#### **4.7.2.2.1 Alternative A – No Action**

Maintaining the current level of management activities and public uses on this Refuge would not result in any new trip generation, nor would the demand for parking increase. Therefore, this alternative would not adversely affect traffic circulation or parking availability.

#### **4.7.2.2.2 Alternative B –Enhance Nesting Habitat**

To implement the seabird nesting enhancements proposed under this alternative, a maximum of 279,000 cubic yards of fill material and clean sand would be delivered to the Refuge, representing approximately 15,500 truck loads at 18 cubic yards per load. Importing this material to the Refuge would therefore generate approximately 31,000 truck trips to and from the site over the course of the project and approximately 120 to 150 truck trips to and from the site each working day. These numbers represent a worst-case scenario. The actual amount of imported material required would be dependent upon the extent of levee widening that is ultimately proposed.

Under the most optimistic estimates, the proposed levee enhancements would be completed in approximately six months, but could take up to two years depending upon the type and size of construction equipment employed to complete the project, hours of operation, weather, and availability of fill material and sand. Some level of construction traffic would be generated throughout the course of the project, with the greatest number of trips occurring during project mobilization and demobilization. These temporary increases in traffic would affect Main Street, Bay Boulevard, and possibly I-5 and the I-5/Main Street on and off ramps, depending upon the origin of the material to be imported. With the exception of construction workers traveling to and from the project site each day (no more than 50 trips per AM and PM peak traffic periods), the trips generated from this project would occur during off-peak hours and would be staggered throughout the day. The temporary increase in traffic as a result of this proposal would not be expected to exceed 5% of the current traffic volumes on the surrounding local streets; therefore, no adverse impacts to local or regional traffic circulation are anticipated.

No additional uses are proposed under this alternative; therefore, no new public use-related trips would be generated under this alternative and there would be no increase in parking demand under this alternative.

#### **4.7.2.2.3 Alternative C – Enhance and Restore Habitat/Expand Public Uses**

A number of restoration scenarios could occur under this alternative, as described in Section 2.3.2.4. In addition, the nesting enhancements proposed in Alternative B would be implemented under any of these scenarios. Table 4-3 presents the estimated volumes of import and export that would be needed for each restoration scenario and the total number of truck trips required to move this material to or from the site over the course of the project.

Based on the amount of material that can be moved into or out of a project site in one day, it is estimated that the maximum number of truck trips that would be generated from the project would range from 120 to 150 truck trips per working day throughout the course of the project. An additional 50 trips per day would be attributed to construction workers traveling to and from the project site. The majority of the trips generated under this alternative would occur during off-peak hours and would be staggered throughout the day. The temporary increase in traffic as a result of this proposal would not be expected to exceed 5% of the current traffic volumes on the surrounding local streets; therefore, no adverse impacts to local or regional traffic circulation are anticipated.

<b>Table 4-3</b> <b>Import/Export Estimates and Associated Truck Trips</b> <b>for Various Restoration Scenarios Under Alternative C</b>			
<b>Restoration Scenario</b>	<b>Estimated Import (cubic yards) <sup>1</sup></b>	<b>Estimated Export (cubic yards)</b>	<b>Estimated Truck Trips<sup>2</sup> (over the life of the project)</b>
Otay Option 1 only	116,000	0	12,890
Otay Option 1 and Salt Works Option 1	116,000	0	12,890
Otay Option 1 and Salt Works Option 2	116,000	0	12,890
Otay Option 2 only	116,000	352,000	52,000
Otay Option 2 and Salt Works Option 1	116,000	186,800	33,640
Otay Option 2 and Salt Works Option 2	116,000	0	12,890
Salt Works Option 1 only	438,600	0	48,740
Salt Works Option 2 only	741,500	0	82,390

<sup>1</sup>The import volumes all include 116,000 cubic yards of clean light-color sand for nesting enhancements.

<sup>2</sup>This figure represents trips to and from the site.

The total number of trips generated by the project could be reduced by using the existing rail line located adjacent to the project site for transporting material into or out of the site. The feasibility of such a measure would be dependent upon the source of the imported material and/or the ultimate destination of any exported material. The most likely option for rail use would be associated with the import of clean sand to the site for use on the proposed nesting areas.

Under Alternative C, public uses on the Refuge would be expanded to include regular guided nature tours of the salt works, the development of an environmental education program near Bayside Elementary School, and the opening of the northern levee of Pond 11 to public access for fishing and wildlife observation. The proposal to expand the current uses on the Refuge would generate additional vehicular trips to and from the Refuge; however, these trips would generally occur during non-peak hours and would not exceed 5% of the existing traffic volumes on the surrounding streets; therefore, the additional trips would not adversely affect local or regional traffic circulation.

With respect to parking demand, the guided nature tours would generate an additional parking demand of six to 10 parking spaces per tour. Adequate space is currently available near the salt works entrance to accommodate this parking on the weekends. If tours were to be conducted during the week, alternate parking arrangement may be required, such as meeting at the Chula Vista Nature Center parking lot and carpooling to the salt works. Such a proposal would not adversely impact available parking in the vicinity of the salt works or at the Nature Center parking lot. The environmental education program proposed in the vicinity of the Bayside Elementary School would generate relatively few

automobile trips, with much of the participation in the program generated from existing students at Bayside Elementary School. Students from other schools would most likely be transported to the site via bus or van; therefore, the limited demand for parking that would be generated by this use could be accommodated on the existing school site or via on-street parking available immediately adjacent to the school.

Opening the northern levee of Pond 11 to public access would create a new demand for parking at the entrance to the levee. The County of San Diego recently renovated the parking lot located immediately to the north of the Refuge along SR-75. This lot, which includes 22 parking spaces, currently provides a staging area for users of the Bayshore Bikeway, as well as visitors to the Biological Study Area. Opening the levee to public fishing and wildlife observation would increase the use of this lot, possibly resulting in demand that exceeds the capacity of the lot. If the lot becomes full, users might inappropriately park along the edge of SR-75, resulting in a potential traffic hazard. As part of the step down planning process, a detailed parking analysis would be prepared to evaluate the potential effects of this proposal on the existing parking lot.

#### **4.7.2.2.4 Alternative D – Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)**

As was addressed in Alternative C, there are also a number of restoration scenarios that could occur under Alternative D. These scenarios and the anticipated number of truck trips to and from the site are presented in Table 4-4.

Table 4-4 Import/Export Estimates and Associated Truck Trips for Various Restoration Scenarios Under Alternative D			
Restoration Scenario	Estimated Import <sup>1</sup> (cubic yards)	Estimated Export (cubic yards)	Estimated Truck Trips <sup>2</sup>
Restored Salt Ponds (modified pond elevations)	135,000	0	15,000
Restored Salt Ponds (modified pond elevations) + Otay Restoration Option 1	135,000	0	15,000
Restored Salt Ponds (modified pond elevations) + Otay Restoration Option 2	127,400	501,800	69,900
Restored Salt Ponds (breach only)	300,700	0	33,400
Restored Salt Ponds (breach only) + Otay Restoration Option 1	127,400	0	14,150
Restored Salt Ponds (breach only) + Otay Restoration Option 2	127,400	336,100	51,500

<sup>1</sup>The import volumes all include 116,000 cubic yards of clean light-color sand for nesting enhancements.

<sup>2</sup>This figure represents trips to and from the site.

Based on the amount of material that can be moved into or out of a project site in one day, it is estimated no more than 120 to 150 truck trips per working day would be generated throughout the course of the project. An additional 50 trips per day would be attributed to construction workers traveling to and from the project site. The majority of the trips generated under this alternative would occur during off-peak hours and would be staggered throughout the day. The temporary increase in traffic as a result of this proposal would not be expected to exceed 5% of the current traffic volumes on the surrounding local streets; therefore, no adverse effects to local or regional traffic circulation are anticipated. As discussed under Alternative C, some reduction in the total number of trips generated by the project could be achieved if some material could be transported to or from the site via the existing rail line in the vicinity of the project.

Under Alternative D, the current public uses permitted on the Refuge would be expanded to include some of the uses proposed under Alternative C, such as regular guided nature tours of the salt works and the development of an environmental education program near Bayside Elementary School. This alternative does not include the proposal to open the northern levee of Pond 11 to public access, but does include the development of an environmental interpretation plan for the areas around the southwest perimeter of the Refuge, as well as the development of wildlife observation points in the same general area.

These proposals would generate additional non-peak hour vehicular trips to and from the Refuge; however, the total number of trips generated would not be expected to exceed 5% of the existing traffic volumes on the surrounding streets. No impacts to the County's new parking facility near Pond 11 would result as levee access is not proposed under this alternative. Many of the interpretive elements and observation areas proposed under this alternative would be accessible to bicyclists traveling along the Bayshore Bikeway, which could reduce some of the vehicular trips that would otherwise be generated.

Because the salt works operation would cease under this alternative, it is possible that the Airport Authority could lease the land currently used for salt processing to another entity. Coordination with the Airport Authority would therefore be necessary to assure the availability of some parking in the vicinity of the restored salt ponds to accommodate the uses proposed within this portion of the Refuge.

The proposal to construct wildlife observation areas along the perimeter of the Refuge would result in limited increases in parking demand at the various locations. However, the additional need for parking that would be generated by this use could be accommodated by the existing parking areas already provided in the vicinity of the proposed observation points.

#### **4.7.3 Effects to Public Utilities/Easements**

This section analyzes the potential effects of the various management alternatives on existing public utilities and easements in the immediate vicinity of the Refuge.

Adverse effects to public utilities and easements would be considered significant if:

- Direct or indirect damage to utilities, utility service, or other public facilities would occur as a result of a proposed action.

- Utilities or other public facilities would be relocated, either permanently or temporarily to accommodate a proposed action.
- Disruption of access to a public utility or other facility or temporary obstruction of an easement would occur during implementation of a proposed action.

#### **4.7.3.1 Sweetwater Marsh Unit**

##### **4.7.3.1.1 Alternative A – No Action**

There are no public utilities located on this Refuge Unit that would be adversely affected by the continuation of current management activities on the Refuge, nor would this alternative adversely affect the existing access easement provided to the Nature Center.

##### **4.7.3.1.2 Alternative B –Habitat Enhancement/Interpretation**

The proposal to improve tidal circulation in the marsh complex by installing an additional culvert under the existing access road to the Refuge office and Nature Center would result in the short-term disruption of vehicular access to and from the Refuge. The timing of this improvement would be coordinated with the Nature Center to minimize disruption to the operation of the Nature Center.

##### **4.7.3.1.3 Alternative C –Habitat Restoration/Enhance Public Use (Preferred Alternative)**

The tidal circulation improvements described in Alternative B are also included in this alternative; therefore, the evaluation of effects from this proposal on the Nature Center's access easement would be the same as that described above. No other impacts to public facilities or easements are anticipated.

#### **4.7.3.2 South San Diego Bay Unit**

##### **4.7.3.2.1 Alternative A – No Action**

The proposal to continue current management activities would have no positive or adverse effects on existing public utilities or easements in the vicinity of this Refuge Unit.

##### **4.7.3.2.2 Alternative B – Enhance Nesting Habitat**

The proposal to enhance nesting opportunities on the salt pond levees would not affect existing public utilities or easements in the project vicinity.

##### **4.7.3.2.3 Alternative C - Enhance and Restore Habitat/Expand Public Uses**

The majority of the utilities and other public facilities that could be affected by the restoration proposals included in this alternative are located within or to the east of the unimproved section of Saturn Boulevard that extends north/south through the Refuge. Many of these facilities are located outside the current Refuge boundary within property owned and maintained by the City of San Diego, while others are included in existing easements that traverse this portion of the Refuge. A bicycle path also extends through this area with some portions included on City owned land and others within an existing public easement. Restoration planning for the Otay River floodplain would require the incorporation of measures to avoid direct and indirect adverse effects to these facilities and public easements. Such adverse effects could include direct impacts during construction and/or indirect impacts following construction as a result of the potential for increased scour within the floodplain, increased riverbank erosion, and/or additional headcutting in the main river channel during heavy storm events. These types of impacts could be avoided by realigning the affected facilities or protecting the facilities in place using bank stabilization techniques, such as riprap, concrete slope protection, geotextile soil

reinforcement, biotechnical measures, and/or grade control structures (e.g. precast concrete mats, armorflex, reinforced concrete drop structures, grouted stone drop structures, cutoff walls). The specific measures to be incorporated into the design would be determined during detailed restoration planning in consultation with the appropriate departments of the City of San Diego and/or other affected agencies. These plans would also address the need for continued maintenance access to the various utilities within the restoration area.

Another potential impact to buried utilities would involve the placement of additional fill above these facilities. The placement of fill over settlement sensitive utility lines could result in damage to the lines, as well as make routine maintenance and repair of these utilities more difficult. To avoid significant adverse effects to the existing utilities within this area, consultation with the affected agencies would be conducted prior to developing final restoration plans and appropriate measures would be incorporated into the restoration plans to protect existing utilities. Such measures could include minimizing the amount of fill to be placed over these utilities, avoiding abrupt changes in fill thickness, and/or upgrading the utilities to handle the additional soil loads.

Grading activities could also disrupt bicycle access through the area; therefore, construction plans would include measures to ensure continued bicycle access from Main Street to Palm Avenue during construction. This may result in the temporary rerouting of the path to separate bicycle users from adjacent construction activity. The proposed changes to the Otay River channel could also require the reconstruction of the existing bridge that crosses the Otay River along unimproved Saturn Boulevard. If changes to the bridge are deemed necessary, the redesign would be coordinated with the City of San Diego, which will be required to maintain the existing bridge and future bicycle path.

Depending upon the final restoration design for the Otay River floodplain, restoration could result in direct and indirect impacts to the Bayshore Bikeway. Direct impacts could occur during excavation if temporary access routes are established to facilitate the off-street transport of fill material from the Otay River floodplain to the salt works. Adverse effects could include physical impacts to the bike path surface, assuming the bike path is constructed prior to restoration, or disruption of bicycle movement along the Bayshore Bikeway during construction. Indirect impacts to the bikeway could occur following construction as a result of increased flood elevations in the vicinity of the western most railroad bridge and/or increased scour in the vicinity of the bridge. To minimize direct impacts, construction plans and phasing would be coordinated with the City and County of San Diego and SANDAG. Additional hydrological studies would be conducted prior to the approval of final restoration plans to determine if and to what extent damage to the railroad bridge could occur as a result of the final restoration design. If these studies determine that there is a potential for impacts to the bridge, appropriate mitigation measures, including possible reinforcement of the bridge structure, would be incorporated into the restoration project.

Finally, this proposal could result in the desire to relocate existing overhead power lines to reduce the potential for avian predation within the restored wetlands. All such proposals would be coordinated with San Diego Gas and Electric prior to completing the final restoration plans.



#### **4.7.3.2.4 Alternative D - Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)**

No impacts to public utilities are anticipated as a result of restoring the salt ponds to tidal action. The effects to public utilities and easements within the Otay River floodplain would be the same as those described under Alternative C.

### **4.7.4 Effects to Public Access, Education, and Recreational Opportunities**

Adverse effects to public access, education, and recreational opportunities would be considered significant if:

- Substantial displacement of public recreation and educational activities or opportunities would occur as a result of a proposed action.
- Existing public access to the bay would be substantially reduced as a result of a proposed action.

#### **4.7.4.1 Sweetwater Marsh Unit**

##### **4.7.4.1.1 Alternative A – No Action**

No changes to public access or the education and recreational opportunities existing in the vicinity of the Refuge would occur as a result of this alternative. Public access would continue to be restricted to the Gunpowder Point and access onto the Refuge would continue to be permitted only via the existing shuttle that transports visitors at no charge from an offsite parking lot to the Chula Vista Nature Center. The environmental education programs currently being implemented by the Nature Center would also continue under this alternative.

No public access routes currently exist through the Refuge that would be disrupted as a result of this or any of the other alternatives proposed for the Sweetwater Marsh Unit.

##### **4.7.4.1.2 Alternative B – Habitat Enhancement/Interpretation**

The effects to public access, education, and recreational opportunities would be the same as described for Alternative A.

##### **4.7.4.1.3 Alternative C –Habitat Restoration/Enhance Public Uses (Preferred Alternative)**

Under this alternative, the environmental educational programs implemented on the Refuge would be expanded to reach additional school children. Public access within the Refuge would remain unchanged; however, the trail system on Gunpowder Point would be redesigned to better accommodate the educational, interpretive, and wildlife observation activities supported by the Refuge.

#### **4.7.4.2 South San Diego Bay Unit**

##### **4.7.4.2.1 Alternative A – No Action**

Under this alternative, public access to the Refuge would continue to be limited to occasional guided nature tours around the salt ponds. Visual access into the Refuge would also continue to be provided along the Bayshore Bikeway. At present, the primary educational activity associated with the salt works relates to the study of *Halobacterium* and other Archaeans (refer to Section 3.4.2.2.) that are supported in the hypersaline waters of the crystallizer ponds. Recreational opportunities occurring in the open waters of the Refuge related to boating and fishing would continue under this alternative.

No public access routes currently exist through the Refuge that would be disrupted as a result of this alternative.

#### **4.7.4.2.2 Alternative B - Enhance Nesting Habitat**

The effects to public access, education, and recreational opportunities would be the same as described for Alternative A.

#### **4.7.4.2.3 Alternative C - Enhance and Restore Habitat/Expand Public Uses**

Public access would be expanded on the Refuge to include the opening of the northern levee of Pond 11. In addition, a proposed alignment for the western end of the Otay Valley Regional Trail is addressed in the CCP to facilitate the implementation of the Otay Valley Regional Park plan. Recreational opportunities occurring in the open waters of the Refuge related to boating and fishing would continue. Restoration of the Otay River floodplain could result in temporary disruptions to public access along the bike path that follows the unimproved portion of Saturn Boulevard, as well as the Bayshore Bikeway (refer to Section 4.7.3.2). Temporary rerouting of these trails may be required to minimize impacts to public access.

The Habitat Heroes environmental education program would continue under this alternative with the proposal to reach additional students through partnerships with other agencies and organizations. The study of *Halobacterium* and other Archaeans would also likely continue because commercial salt production is proposed as a component of this alternative.

#### **4.7.4.2.4 Alternative D - Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)**

Under Alternative D, expansion of public access on the Refuge would be limited to the possible construction of Otay Valley Regional Trail through the eastern end of the Refuge. Access would not be permitted on the northern levee of Pond 11. Visual access onto the Refuge would be expanded as the result of the construction of various observation areas along the perimeter of the Refuge.

Potential short term impacts to public access along the Bayshore Bikeway and on the bike path in Saturn Boulevard related to the restoration of the Otay River floodplain would also occur under this alternative, but could be minimized through appropriate rerouting of public access during construction (refer to Section 4.7.3.2).

The Habitat Heroes environmental education program would continue under this alternative; however, opportunities for studying *Halobacterium* and other Archaeans would be eliminated as a result of the closure of the salt works.

### **4.7.5 Effects Related to Vectors and Odors**

This section discusses the potential prevalence of vector populations under each of the alternatives, as well as the potential generation of unpleasant odors. Effects related to vectors would be considered significant if:

- Habitat changes would necessitate substantially increasing levels of mosquito abatement programs to maintain mosquito populations at pre-project levels (adverse).

- Habitat changes would result in a substantial decline of available mosquito breeding habitat (beneficial).

The generation of offensive odors could represent a nuisance to adjacent residents located in adjacent recreational areas, work sites, and commercial areas. Offensive odors can represent a significant adverse effect if the strength and/or the persistence of the odors are substantial and if the odors would affect a substantial number of people.

#### **4.7.5.1 Sweetwater Marsh Unit**

##### **Vectors**

No changes related to the production or control of vectors are anticipated under any of the alternatives being considered for the Sweetwater Marsh Unit. The enhancement and restoration proposals addressed in Alternatives B and C address only salt marsh and upland habitats; no significant changes to the freshwater and brackish water marshes located along the extreme eastern edge of the Refuge are proposed. Therefore, no significant shift in the Refuge's current mosquito composition would be expected under either of these alternatives.

##### **Odors**

The excavation proposals included in Alternatives B and C could expose decomposed organic material resulting in the generation of some odors during project implementation. No odors would be generated under Alternative A. The enhancement and restoration sites proposed under Alternatives B and C are generally located in remote areas of the Refuge separated from human receptors by substantial areas of open space. No adverse effects related to unpleasant odors are therefore anticipated under any of the proposed alternatives.

#### **4.7.5.2 South San Diego Bay Unit**

##### **Vectors**

No proposals are included under Alternatives A or B that would change the existing conditions within the Otay River floodplain; therefore, the Refuge's current mosquito composition would remain unaltered.

Under Alternative C, the freshwater habitat that occurs within the Otay River floodplain would be expanded and salt marsh habitat would be restored within much of the remaining floodplain. These changes have the potential to alter the Refuge's current mosquito species composition. The final restoration plans would take into consideration the need to avoid creating habitat that could benefit mosquito breeding in proposed freshwater and brackish wetland habitats. The plans would also include designs that provide adequate access paths for aquatic predators that feed on mosquito larvae. One such design would involve maintaining deep water channels (greater than 4 feet) that break up areas of dense emergent vegetation.

The restoration proposal within Alternatives C and D to create 60 to 90 acres of salt marsh vegetation within the Otay River floodplain would provide potential habitat for *Ochlerotatus taeniorhynchus* and *Ochlerotatus squamiger*, two salt marsh mosquitoes that reproduce in the intertidal marshes of the California coast. These mosquitoes are not currently suspected of carrying human diseases, but can be a nuisance during certain times of the year. Salt marsh mosquito production would be monitored and appropriate control would be considered if production becomes a significant nuisance to adjacent residents.

The restoration proposals for the salt ponds under Alternatives C and D include predominantly low and mid-marsh habitat that is inundated daily by the tides; therefore, little habitat appropriate for salt marsh mosquito breeding would be created. There is a potential for the creation of conditions conducive to salt marsh mosquito production along the edge of Pond 10A, but this potential would be minimized by appropriate contouring of the pond edges to reduce pooling of water after higher high tide events.

No effects on mosquito species composition would result from developing the managed water systems proposed under Alternative D, because the ponds would be maintained at salinities that would not support mosquito production.

### **Odors**

The existing operation at the salt works results in the generation of odors within some ponds due to the decomposition of organic materials. These odors are particularly prevalent in Pond 20 and occasionally in Pond 10A. This condition would continue under Alternatives A or B.

Grading activities related to restoration of one or more of the salt ponds, as proposed in Alternatives C and D, could expose decomposed organic material resulting in the generation of some odors during grading. If noticeable, those receptors most likely affected would be downwind of the excavation and/or located in the vicinity of Pond 10A. The principal wind direction in the vicinity of the main salt works complex is to the east; therefore, any odors generated by excavation within the salt ponds in this area would most likely be directed to the east, where industrial activity is the predominant land use. Although some residences are located between I-5 and Bay Boulevard, they occur a considerable distance from the restoration site and would likely not be affected by nuisance odors. There is the potential for residents in proximity to Pond 10A to experience some adverse odors during construction; however, these odors, if generated, would occur only for a short period of time during excavation within Pond 10A. Once restoration is completed, the odors generated from this pond under current conditions (during periods when the water levels in the pond are very low) would be expected to diminish as a result of the introduction of tidal circulation.

The implementation of Alternative C would require some reconfiguration of the remaining salt ponds to accommodate solar salt production. Just as some ponds in the current system produce unpleasant odors at certain times of the year, other ponds could generate similar odors once the system is reconfigured. It is not possible at this time to predict where in the system this could occur. Based on the current land uses in the vicinity of the salt works, the potential generation of odors from the reconfigured salt operation is not expected to adversely affect any human receptors. This situation would not occur under Alternative D.

### **4.7.6 Effects to Economics/Employment**

This section discusses the direct and indirect economic effects on the regional economy of implementing the various alternatives presented for each Refuge. Economic or social changes resulting from an action are considered to produce significant effects if they result in a substantial adverse physical change in the environment (e.g., urban blight).

#### **4.7.6.1 Sweetwater Marsh Unit**

Historically, the annual base budget for the Sweetwater Marsh Unit comprises most of the Refuge's annual funding. Other revenue sources include supplemental annual funding for control of invasive species and brush management and special projects funded through Federal challenge cost-share grants. In typical years, approximately 85% of the Refuge's operating budget is spent on salaries and employee benefits. The remainder is usually spent on routine operating expenses, annual maintenance, equipment, supplies, contractors, vendors, volunteer projects, travel, and training. The Refuge does not obtain any income from visitors, as access to those portions of the Refuge that are open to the public does not require an entrance fee.

Because most Refuge funding comes from the Federal government and other sources that are external to the local economy, the Refuge's payroll and other expenditures comprise net revenue for the local economy. Thus, every federally supported job at the Refuge results in local expenditures and indirectly supports additional employment in the region.

Although the land included within the Refuge is federally owned and therefore provides no property taxes, several factors offset this loss of property tax revenue to local government. First, Refuge lands and waters demand little in the way of expensive infrastructure or services. Second, when the Service acquires private land in fee, Congress allocates payments to counties under the Refuge Revenue Sharing Act to partially compensate for the loss of property taxes. In addition, the designation of this property as a Refuge and the resources protected within the Refuge contribute to the local economy by drawing visitors from outside the county to the area for bird watching, environmental interpretation, and other ecotourism related activities. While visiting areas such as this Refuge, visitors contribute additional sales taxes to local governments, as well as transit occupancy taxes (TOT) that are used by local governments to fund a variety of local services. Most visitors to this Refuge Unit also provide funds to the Chula Vista Nature Center, operated by the City of Chula Vista, through a Nature Center entrance fee and any purchases made at the Center's gift shop.

##### **Alternative A – No Action**

Under the No Action Alternative, the Refuge's annual base budget and staffing are expected to remain comparable to historical funding and staffing levels. In 2003, the Refuge Complex's base budget was approximately \$1.5 million, sufficient to support the equivalent of approximately 15 full time equivalent (FTE) employees. Under this alternative, staffing would be maintained at current levels. These existing jobs would represent a small, yet positive, contribution to the regional economy.

##### **Alternative B –Habitat Enhancement/Interpretation**

This alternative includes several one-time construction projects associated with improving tidal circulation within the marsh complex. The implementation of these projects, which are estimated to cost approximately \$500,000, would likely involve private contractors, thereby providing additional minor benefits to the regional economy in terms of additional short-term jobs in fields such as construction, engineering, and biological consulting.

##### **Alternative C –Habitat Restoration/Enhance Public Uses (Preferred Alternative)**

Under this alternative, staffing within the Refuge Complex would be increased to approximately 18 FTEs. Employment would increase in the categories of biology, public use, and resource management. In addition, approximately \$3 million in habitat restoration projects are proposed under this alternative. This money would be used to pay for contractors, equipment rentals, and materials needed to implement the proposed

projects. Although the additional influx of money into the local economy as a result of this work would be temporary, it would still represent a positive effect on the regional economy.

#### **4.7.6.2 South San Diego Bay Unit**

Similar to the Sweetwater Marsh Unit, most of the annual funding for the South San Diego Bay Unit is provided by the Refuge's annual budget. Other revenue sources include supplemental annual funding for control of invasive species and brush management and special projects funded through Federal challenge cost-share grants. No income is provided to the Refuge in the form of entrance fees.

As described above, the Refuge's payroll and other expenditures comprise net revenue for the local economy and indirectly support additional employment in the region. In addition, payments are made to the County of San Diego under the Refuge Revenue Sharing Act to partially compensate for the loss of property taxes and visitors to the Refuge contribute additional sales taxes to local governments, as well as TOT.

##### **Alternative A – No Action**

Under the No Action Alternative, the Refuge's annual base budget and staffing are expected to remain comparable to historical funding and staffing levels. As a result, the Refuge's annual base budget would continue to contribute minor positive effects on the regional economy.

Also under this alternative, the existing commercial solar salt operation would remain in production. This operation currently employs approximately 22 people with overall estimated annual earnings in 1994 of \$670,000 and estimate total sales of \$4.9 million (*Niehaus 1994 in USFWS 1999*). A percentage of the revenues from this operation are currently paid to the Airport Authority by the salt works operator in accordance with the current lease between the Airport Authority and South Bay Salt Works. In 2005, the Airport Authority received rent payments from the salt works in the amount of \$150,000 and approximately \$300,000 was paid in sales tax to state and local municipalities (Strahl pers. comm.). Under the Cooperative Agreement no revenues from this operation would come to the Service until after 2009.

No significant new benefits or adverse effects to the regional economy would occur under this alternative.

##### **Alternative B – Enhance Nesting Habitat**

Under this alternative, the annual budget and staffing for the Refuge would remain generally unchanged from current conditions. This alternative does however include a variety of enhancement projects that, when implemented, would involve a total expenditure of approximately \$2.5 million. Although this is a relatively minor amount of funding when viewed in terms of the regional economy, it would result in direct expenditures that would be used to purchase materials and retain contractors. This alternative would therefore provide minor benefits to the regional economy.

##### **Alternative C – Enhance and Restore Habitat/Expand Public Uses**

Under this alternative, the number of FTEs within the Refuge Complex would increase to 20 FTEs, with increases in staffing related primarily to volunteer coordination, maintenance, and resource management. Up to an additional \$9 million in restoration

funds would be expended over a period of a number of years. This expenditure would represent a minor benefit to the regional economy in terms of additional short-term jobs and local purchases.

The expansion of public uses on the Refuge would result in several one time expenditures to design and construct necessary facilities. Expanding these uses is expected to generate additional visitors to the region, due to the exceptional wildlife observation opportunities that would be available under this alternative. The economic effects of establishing the South San Diego Bay Unit were evaluated as part of the Environmental Assessment for Refuge establishment (*USFWS 1999*). This analysis, which is incorporated into this document by reference, projected the net annual increase in visitors to the area that could be attributed to the South San Diego Bay Unit, to be up to 80,000 (*Niehaus 1994*). This estimate did not specifically take into consideration the provisions within this alternative for additional habitat areas and new opportunities for wildlife observation that are included within this alternative. The net annual increase attributed to this Refuge could therefore be higher. The increase of up to 80,000 additional visitors to the region translates to an estimated increase in expenditures related to retail trade, lodging, and food service of as much as \$7.5 million (in constant 1992 dollars). Indirect employment of up to 172 jobs with associated earnings of \$4.5 million could also be expected (*Niehaus 1994*).

To accommodate proposed restoration, the footprint of the current solar salt operation would be reduced, thereby reducing the annual revenues for the operation. This would likely lead to the elimination of several positions at the facility. Although significant to those directly affected by job loss and the loss in revenues to the company from downsizing, in terms of the region's economy, the adverse effects would be minimal. The additional benefits derived from increasing Refuge staffing would offset some of the losses to the local economy from downsizing the salt works operation.

#### **Alternative D – Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)**

Under this alternative, staffing at the Refuge Complex could increase to a total of 24 FTEs and one temporary full time equivalent, with increases in staffing related primarily to biology, water management, resource management and monitoring, and maintenance. This alternative also proposes the expenditure of an estimated \$11 million to restore coastal wetlands and establish water and brine management areas within the Refuge. The funds, which would be expended over a number of several years, would represent a minor benefit to the regional economy in terms of additional short-term jobs and local purchases. Wildlife observation opportunities, although different from those provided in Alternative C, would also be expanded.

The habitat restoration proposals included under this alternative would require the closure of the existing solar salt operation and the loss of approximately 22 jobs. The reduction in annual earnings as a result of eliminating the salt works was estimated in the environmental assessment prepared for establishment of the South San Diego Bay Unit (*USFWS 1999*) at \$670,000 and the annual loss in sales was estimated to be in the range of \$5 million dollars (in constant 1992 dollars). Losses to the regional economy would be higher in 2007 dollars, which is when the current lease and Refuge Special Use Permit expire. There are no other viable locations in the region to establish a new solar salt operation; therefore, relocation of this operation to another site in an effort to maintain the current economic benefits of a facility of this size would not be possible.

Based on the estimates provided in the environmental assessment (*USFWS 1999*), it would appear that the economic contributions to the region related to increases in visitors, although not considered regionally significant, would offset the economic losses to the region associated with the elimination of the salt works. The implementation of this alternative would therefore have no adverse effect on the regional economy.

#### **4.7.7 Effects to Environmental Justice**

This section evaluates the potential for adverse human health or environmental effects to minority populations or low-income populations living in the vicinity of the south bay Refuges as a result of implementing the various actions proposed in each alternative. Impacts related to environmental justice would be considered significant if:

A proposed action would result in disproportionate adverse human health impacts or environmental effects to low-income or minority populations.

##### **4.7.7.1 Sweetwater Marsh Unit**

###### **4.7.7.1.1 Alternative A – No Action**

Continuing to manage the Sweetwater Marsh Unit as it has historically been managed would not result in any adverse human health or environmental effects to minority or low-income populations. Environmental education and interpretation programs currently supported by the Refuge, such as Sweetwater Safari, would continue to provide benefits to school children, including minority and low-income populations. Transportation onto the Refuge, which is provided to the public free of charge by the City of Chula Vista, is available from a location that is easily accessible via public transportation, including city buses and the San Diego Trolley. Transportation is also available at no cost for those schools that do not have funding to transport students from the school to the Nature Center and Refuge for environmental education classes. This transportation is funded through a private grant in support of the Sweetwater Safari program.

###### **4.7.7.1.2 Alternative B –Habitat Enhancement/Interpretation**

Those aspects of this alternative that involve Refuge participation in watershed planning and continued oversight of contaminants evaluation and remediation would provide a benefit to the surrounding communities. The improvements in tidal circulation within the marsh could also provide some benefits to the bay with respect to improved water quality. The other benefits related to environmental justice that are described in Alternative A would also be provided under this alternative.

###### **4.7.7.1.3 Alternative C –Habitat Restoration/Enhance Public Uses (Preferred Alternative)**

Under this alternative, the existing public uses would be expanded to include additional opportunities for environmental interpretation. This interpretation would address an array of topics including Native American use of the lands within the Refuge. The outreach program that is included under this alternative would provide opportunities for inviting a larger segment of the community to participate in Refuge activities.

##### **4.7.7.2 South San Diego Bay Unit**

###### **4.7.7.2.1 Alternative A – No Action**

Continuing to manage the South San Diego Bay Unit as it has been managed since its establishment in 1999 would not result in any adverse human health or environmental effects to minority or low-income populations.



#### **4.7.7.2.2 Alternative B - Enhance Nesting Habitat**

The proposals for enhancement of endangered species nesting would not result in any adverse human health or environmental effects to minority or low-income populations.

#### **4.7.7.2.3 Alternative C - Enhance and Restore Habitat/Expand Public Uses**

This alternative includes various proposals that would benefit the environment in the vicinity of the Refuge including restoration of the Otay River floodplain and participation in watershed planning efforts for the Otay River watershed. The implementation of these proposals would improve the quality of the water entering the bay, reduce habitat quality for mosquito production, and provide limited benefits with respect to upstream flooding in the vicinity of Nestor Creek. The public use proposals included under this alternative would also provide opportunities for surrounding residents to participate in environmental education and other programs to be implemented on the Refuge. No adverse effects of the proposed restoration or public use proposals related to environmental justice are anticipated.

#### **4.7.7.2.4 Alternative D - Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)**

The benefits related to human health and the environment described under Alternative C would also occur as a result of implementing this alternative. In addition, opportunities for wildlife observation and environmental interpretation would be expanded, providing residents of the surrounding communities with recreational and educational activities that can be easily accessed via public transportation, by bicycle, and on foot.

### **4.8 Summary of Effects**

#### **4.8.1 Sweetwater Marsh Unit**

Provided in Table 4-5 is a summary of the potential effects associated with each of alternatives evaluated for this Refuge Unit. Table 4-7 provides a summary of the habitat changes under each alternative, and Tables 4-8 and 4-9 summarize the habitat changes that would occur if the preferred alternatives for both the Sweetwater Marsh Unit and South San Diego Bay Unit were to be implemented.

#### **4.8.2 South San Diego Bay Unit**

Provided in Table 4-6 is a summary of the potential effects associated with each of alternatives evaluated for this Refuge Unit. Table 4-7 provides a summary of the habitat changes under each alternative, and Tables 4-8 and 4-9 summarize the habitat changes that would occur if the preferred alternatives for both the Sweetwater Marsh Unit and South San Diego Bay Unit were to be implemented.

**Table 4-5**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, or C for the Sweetwater Marsh Unit**

Resource	Alternative A	Alternative B	Alternative C
<b>Physical Environment</b>			
Topography/Visual Quality	No Change in Existing Conditions	No Change in Existing Conditions	Moderate benefits to visual quality would result from replacing weedy, nonnative vegetation on Gunpowder Point with native habitat.
Agricultural Resources	No Change in Existing Conditions	No Change in Existing Conditions	No adverse effects.
Hydrology	No Change in Existing Conditions	Various impediments to tidal and freshwater circulation in the marsh would be removed representing a moderate benefit to overall habitat quality in the marsh.	Same as Alternative B
Water Quality	No Change in Existing Conditions	Implementation of Best Management Practices would reduce the potential for adverse effect from grading to less than significant.	Same as Alternative B
<b>Habitat</b>			
Coastal Salt Marsh	No Change in Existing Conditions	Minor temporary adverse affects could result during the implementation of tidal circulation improvements, but these would be offset by the moderate benefits to habitat quality that would result from improving tidal and freshwater circulation within the marsh.	Minor temporary adverse affects could result during the implementation of proposed restoration and circulation improvements, but these would be more than offset by the significant benefits to habitat quality would result from improved circulation and the restoration of 25 acres of intertidal wetlands.
Native Uplands	No Change in Existing Conditions	Slight benefits to upland s habitat would result from increased control of nonnative invasive plant species.	Significant benefits would result from the restoration of 20 acres of native upland habitat.

**Table 4-5 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, or C for the Sweetwater Marsh Unit**

Resource	Alternative A	Alternative B	Alternative C
<b><i>Habitat(continued)</i></b>			
Nesting Habitat	No Change in Existing Conditions	Moderate benefits would result from expanded management at the D Street Fill.	<u>According to the Biological Opinion prepared in 1988, the historic tern nesting site on the D Street Fill was 44 acres. Conversion of the 13 acres of the Fill to wetland would still preserve 33 acres of nesting habitat on the Refuge and 12 acres of nesting habitat on the Port property, a total of 45 acres. Therefore, this proposal would not adversely affect the number of historic nesting acres in this area. Further, implementation of the strategies describe in Objective 2.1 for the Sweetwater Marsh Unit is intended to increase the number of least tern and snowy plover nests established annually in this area, as well as improve fledging success for each species.</u>

**Table 4-5 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, or C for the Sweetwater Marsh Unit**

Resource	Alternative A	Alternative B	Alternative C
<b>Wildlife and Fisheries (continued)</b>			
All Birds	No Change in Existing Conditions	Management of salt marsh habitat would be expanded; tidal and freshwater circulation within the marsh improved; and the seabird nesting area on D Street Fill would be enhanced. These actions would provide moderate benefit to birds.	In addition to the actions proposed under Alternative B, 25 acres of cordgrass-dominated salt marsh would be restored; 33 acres of the D Street Fill would be designated for <u>tern and plover</u> nesting; and 20 acres of native upland habitat would be restored, representing a significant benefit to birds.
Waterfowl	No Change in Existing Conditions	Action described above would provide slight benefits for waterfowl.	Same as Alternative B
Seabirds	No Change in Existing Conditions	Action described above would provide moderate benefits for seabirds.	Actions described above would provide significant benefits for seabirds.
Shorebirds and Other Waterbirds	No Change in Existing Conditions	Action described above would provide moderate benefits for shorebirds and other waterbirds.	Actions described above would provide moderate benefits for shorebirds and other waterbirds.
Raptors	No Change in Existing Conditions	No Change in Existing Conditions	No Change in Existing Conditions
Other Land Birds	No Change in Existing Conditions	No Change in Existing Conditions	The restoration of 20 acres of native upland habitat would significantly benefit land birds, particularly those associated with coastal sage scrub and maritime succulent scrub habitat.

**Table 4-5 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, or C for the Sweetwater Marsh Unit**

Resource	Alternative A	Alternative B	Alternative C
<b><i>Wildlife and Fisheries (continued)</i></b>			
Mammals	No Change in Existing Conditions	No Change in Existing Conditions	No adverse effects or benefits.
Reptiles/Amphibians	No Change in Existing Conditions	No Change in Existing Conditions	Minor benefits following restoration of Gunpowder Point.
Invertebrates	No Change in Existing Conditions	Slight benefit as a result of improved tidal circulation within the marsh.	Moderate benefit as a result of improved tidal circulation and restored intertidal and upland habitat.
Fish	No Change in Existing Conditions	Slight benefit as a result of improved tidal circulation within the marsh.	Moderate benefit as a result of improved tidal circulation and restored intertidal habitat.
<b><i>Endangered &amp; Threatened Species</i></b>			
California least tern	No Change in Existing Conditions	Enhance of existing nesting habitat would provide slight benefits.	<u>Implementing the strategies for increasing least tern productivity, including improved nesting substrate, vegetation control, and new fencing and signage, would result in moderate benefits to the least tern population range wide.</u>
Light-footed clapper rail	No Change in Existing Conditions	Moderate benefits are anticipated as a result of higher quality cordgrass stands following improvements in tidal circulation.	Same as Alternative B.
Salt marsh bird's beak	No Change in Existing Conditions	Moderate benefits due to expanded management of high marsh and improved tidal and freshwater circulation within the marsh	Same as Alternative B.

<b>Table 4-5 (continued)</b> <b>Summary of Potential Effects of Implementing</b> <b>Alternatives A, B, or C for the Sweetwater Marsh Unit</b>			
Resource	Alternative A	Alternative B	Alternative C
<b><i>Endangered &amp; Threatened Species (continued)</i></b>			
California brown pelican	No Change in Existing Conditions	No new adverse or beneficial effects.	No new adverse or beneficial effects.
Western snowy plover	No Change in Existing Conditions	Enhance of existing nesting habitat and better access to foraging habitat would provide moderate benefits.	<u>Strategies to improve nesting substrate, provide new fencing, and improve access to foraging areas, would result in moderate benefits for snowy plovers.</u>
California gnatcatcher	No Change in Existing Conditions	No Change in Existing Conditions	Moderate benefits would result from the restoration of coastal sage scrub habitat on Gunpowder Point.
<b><i>Public Use</i></b>			
Hunting/Fishing	No Change in Existing Conditions (Refuge Unit is closed to hunting and fishing.)	No Change in Existing Conditions	No Change in Existing Conditions
Wildlife Observation/Photography	No Change in Existing Conditions (Opportunities for these uses are provided at Gunpowder Point.)	No Change in Existing Conditions	Realigned trail system on Gunpowder Point and restored upland habitat would moderately improve opportunities for wildlife observation and photography.
Environmental Education	No Change in Existing Conditions (Opportunities for this use are provided at Gunpowder Point.)	No Change in Existing Conditions	Realigned trail system and new interpretive elements would significantly benefit environmental education programs.
Environmental Interpretation	No Change in Existing Conditions	Moderate benefits would result from new interpretive elements near Paradise Marsh and the F&G Street Marsh.	Realigned trail system and new interpretive elements would significantly benefit the Refuge.
Chula Vista Nature Center	No Change in Existing Conditions	No Change in Existing Conditions	New interpretive elements would complement the exhibits provided within the Nature Center.

**Table 4-5 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, or C for the Sweetwater Marsh Unit**

Resource	Alternative A	Alternative B	Alternative C
<b><i>Cultural Resources</i></b>			
Historic	No Change in Existing Conditions	No Change in Existing Conditions	Modifications to the site of the Hercules Powder Company during habitat restoration could result in an adverse effect, which would require mitigation.
Archaeological	No Change in Existing Conditions	No Change in Existing Conditions	Potential for impacts to subsurface deposits. Mitigation would be implemented if resources are discovered that could be impacted.
<b><i>Socioeconomic</i></b>			
Land Use/Public Utilities	No Change in Existing Conditions	No Change in Existing Conditions	No Change in Existing Conditions
Traffic/Parking	No Change in Existing Conditions	No Change in Existing Conditions	Slight increases in the demand for parking would not adversely affect current parking availability.
Access/Education/Recreation	No Change in Existing Conditions	No Change in Existing Conditions	Redesigning the existing trail system and upgrading the interpretive elements to better compliment educational programs would provide significant benefits.
Vectors/Odors	No Change in Existing Conditions	Improved tidal circulation would provide moderate benefits related to but odors and vectors.	Same as Alternative B
Economics/Employment	No Change in Existing Conditions	Several one-time construction projects would provide minor benefits to the economy through the use of private contractors.	Same as Alternative B, plus slight increase in visitors would benefit the local economy.
Environmental Justice	No Change in Existing Conditions	No Change in Existing Conditions	New interpretation would provide moderate benefits.

**Table 4-6**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, C, or D for the South San Diego Bay Unit**

Resource	Alternative A	Alternative B	Alternative C	Alternative D
<b>Physical Environment</b>				
Topography/Visual Quality of the Otay River Floodplain	No Change in Existing Conditions	No Change in Existing Conditions	<p>This alternative proposes some filling within the floodplain in areas designated for upland restoration. These areas would not be raised more than eight feet. At this depth, public views of the restored floodplain and distance views of the bay and ocean would be preserved, and significant adverse affects to visual quality would be avoided.</p> <p>Restoring the existing weedy fields with native upland and wetland habitat would be viewed as a moderate benefit to the area's visual quality.</p>	Same as Alternative C
Visual Quality within San Diego Bay	No Change in Existing Conditions	No Change in Existing Conditions	<p>Converting 200 to 440 acres of salt ponds to coastal wetlands would alter views of the South Bay by replacing open water with habitat that is only inundated during high tides. This could be viewed by some as an adverse effect, while others may view this change as inconsequential. Restoring the area to its historic condition is not considered by the Service to be an adverse effect to visual quality.</p>	Under this alternative, 650 acres of open water would be converted to intertidal habitat. The conclusions regarding effects to visual quality that are presented for Alternative C would also apply to this alternative.



**Table 4-6 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, C, or D for the South San Diego Bay Unit**

Resource	Alternative A	Alternative B	Alternative C	Alternative D
<b><i>Physical Environment(continued)</i></b>				
Agricultural Lands	No alteration of the existing soils would occur; therefore, no adverse effects to prime farmland would be expected.	Same as Alternative A	Restoring the Otay River floodplain to native habitat would eliminate the future use of this area for agricultural production, therefore, resulting in a significant adverse effect to prime farmland.	Same as Alternative C
Noise	No Change in Existing Conditions	No Change in Existing Conditions	Grading associated with restoration could result in short-term noise impacts to adjacent homes. Appropriate noise attenuating measures would be included in the final restoration plans to reduce any potentially significant adverse effects to below a level of significance.	Same as Alternative C
Upstream Flood Characteristics (Otay River Floodplain)	No Change in Existing Conditions	No Change in Existing Conditions	Preliminary modeling of the flood characteristics in the Otay River floodplain following restoration indicates that upstream backwater effects during a 100-year flood would be somewhat reduced and peak water surface elevations would be slightly lower (1 to 2 feet lower) near adjacent development. Restoration is therefore not expected to exacerbate predicted flood levels upstream of the Refuge.	Same as Alternative C

**Table 4-6 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, C, or D for the South San Diego Bay Unit**

Resource	Alternative A	Alternative B	Alternative C	Alternative D
<b><i>Physical Environment(continued)</i></b>				
Downstream Flood Characteristics (Otay River Floodplain)	No Change in Existing Conditions	No Change in Existing Conditions	Preliminary modeling of the flood characteristics in the Otay River floodplain indicate that under existing conditions the peak water surface elevation at the railroad bridge is 13 feet NAVD88. Under restored conditions, the elevation would be 1 to 2 feet higher. The current elevation of the railroad bridge is approximately 14.3 feet NAVD88; therefore, the predicted increase in the peak water surface elevation at the railroad bridge could adversely affect the structural integrity of the bridge. Potential adverse effects would be avoided through the implementation of appropriate measures, identified in coordination with the City of San Diego, to protect the integrity of the bridge during a flood event.	Same as Alternative C
Water Quality (Effects of grading)	No Change in Existing Conditions	Grading would be confined to the salt ponds; therefore, no adverse effects to the water quality in the bay are anticipated.	Implementation of Best Management Practices would reduce the potential for adverse effect to less than significant.	Same as Alternative C

**Table 4-6 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, C, or D for the South San Diego Bay Unit**

Resource	Alternative A	Alternative B	Alternative C	Alternative D
<b><i>Physical Environment(continued)</i></b>				
Water Quality (Effects of breaching salt pond levees)	No Change in Existing Conditions	No Change in Existing Conditions	Temporary increases in turbidity and salinity levels in the south end of the bay are not expected to adversely affect water quality in the bay.	Short term adverse effects (lasting less than a month) could result from breaching the salt ponds; however, the effects to water quality bay wide would be less than significant.
<b><i>Habitats</i></b>				
Shallow Subtidal	No Change in Existing Conditions	All enhancement activities would be confined to the salt ponds, which do not support shallow subtidal habitat; therefore, this alternative would have no effect on shallow subtidal habitat.	Short-term, relatively low increases in salinity (approximately 50 ppt during the first ebb tide) would occur immediately to the north of the ponds following pond breaching. These conditions are not expected to adversely impact organisms supported by the adjacent shallow subtidal habitat.	The temporary increases in salinity from pond breaching under this alternative would be substantially higher (120 ppt) than ambient levels (33 to 40 ppt). Potentially significant short term impacts to shallow subtidal habitat in proximity to the salt ponds could occur. Pre- and post-project monitoring would determine the extent of impact. Mitigation for any impacts would be provided through salt pond restoration. Mitigation for any impacts to eelgrass would be provided in accordance with the Southern California Eelgrass Mitigation Policy.

**Table 4-6 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, C, or D for the South San Diego Bay Unit**

Resource	Alternative A	Alternative B	Alternative C	Alternative D
<b><i>Habitats (continued)</i></b>				
Intertidal (Mudflats and Salt Marsh)	No Change in Existing Conditions	No Change in Existing Conditions	Within the Otay River floodplain, restoration could result in temporary impacts to about 6 acres of intertidal habitat. Another 4 acres of high marsh habitat could be lost to implement public use proposals. These impacts would be more than offset by the restoration of approximately 260 to 525 acres of intertidal wetlands. The proposed restoration would represent a significant benefit to intertidal habitat.	Temporary impacts to <u>intertidal habitat</u> of up to 6 acres <u>would occur in</u> the Otay River floodplain and <u>18 acres of salt pond habitat would be converted to nesting habitat</u> . These impacts would be more than offset by the restoration of <u>63 to 88 acres of intertidal wetlands within the Otay River flood plain</u> . <u>Further, 650 acres of salt ponds would be converted to intertidal habitat, representing a significant increase in intertidal habitat in the bay.</u>
Freshwater Wetlands	No Change in Existing Conditions	No Change in Existing Conditions	<u>Restoration within the Otay River floodplain could result in temporary impacts to 3 acres of freshwater wetlands. This loss would be more than offset by the restoration of 16 acres of freshwater wetlands, representing a moderate benefit.</u>	Same as Alternative C
Upland Habitat	No Change in Existing Conditions	No Change in Existing Conditions	Between 40 and 60 acres of non-native uplands, dominated by garland chrysanthemum, would be restored to native upland habitat, representing a significant benefit.	Same as Alternative C

**Table 4-6 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, C, or D for the South San Diego Bay Unit**

Resource	Alternative A	Alternative B	Alternative C	Alternative D
<b>Wildlife and Fisheries</b>				
All Birds	No Change in Existing Conditions	Expanded management within the open bay and a public outreach program to reduce the accumulation of discarded fishing line would provide moderate benefits by reducing the effects of human disturbance on bird species supported on this Refuge Unit.	Human disturbance in the vicinity of Pond 11 could result from opening the northern levee to public access. Activities would be monitored and if significant adverse effects are identified, changes (e.g., initiating seasonal closures) would be implemented to reduce impacts to below a level of significance.	The impacts related to public uses at Pond 11 would not occur under this alternative. Potential disturbances to birds could however occur as a result of creating an interpretive trail around Pond 28. Mitigation would be the same as that described for Alternative C.
Waterfowl	No Change in Existing Conditions	Same as above.	Restoration of coastal wetlands would provide additional foraging habitat for waterfowl. The conversion of some salt ponds to intertidal habitat could alter current rafting patterns, but the overall effect of restoration is expected to be beneficial.	Same as Alternative C.
Seabirds	No Change in Existing Conditions	Proposals to enhance nesting habitat and provide about 20 acres of new nesting area within the salt ponds would provide moderate benefits to seabirds.	Seabirds would benefit from enhanced and newly created nesting habitat; however, salt pond restoration would eliminate open water areas around traditional nest sites, which could alter the nesting patterns for some species. Monitoring/adaptive management would address potential impacts.	Same as Alternative C.

**Table 4-6 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, C, or D for the South San Diego Bay Unit**

Resource	Alternative A	Alternative B	Alternative C	Alternative D
<b>Wildlife and Fisheries (continued)</b>				
Shorebirds	No Change in Existing Conditions	Recontouring of the levee slopes would improve foraging access along the pond edges. In addition, shorebirds that nest at the salt works could benefit from nesting enhancements.	Restoration of coastal wetlands within the Otay River floodplain and the salt ponds would provide additional foraging habitat for shorebirds, representing a significant benefit.	Same as Alternative C
Phalaropes/Eared Grebes	No Change in Existing Conditions	No Change in Existing Conditions	A reduction in the availability of brine invertebrates within the salt ponds could cause phalaropes and grebes to abandon the use of this area during migration. Although this would reduce the diversity and abundance of shorebirds at the salt works, this would not result in significant adverse effects to these species range wide.	Although salt production would be eliminated under this alternative, a managed brine water component has been incorporated into the restoration proposal to ensure the continued availability of brine invertebrates for these species, albeit at a reduced density. The consequences of reducing the availability of brine invertebrates would be the same as described in Alternative C.
Other Waterbirds	No Change in Existing Conditions	No Change in Existing Conditions	Restoration of foraging habitat would represent a significant benefit.	Same as Alternative C

**Table 4-6 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, C, or D for the South San Diego Bay Unit**

Resource	Alternative A	Alternative B	Alternative C	Alternative D
<b><i>Wildlife and Fisheries (continued)</i></b>				
Raptors	No Change in Existing Conditions (some individual raptors could be removed through predator management)	Same as Alternative A	Non-native upland habitat would be replaced with coastal wetlands and native upland habitat, which could reduce the availability of some prey species for raptors. Because the existing habitat is so degraded, restoration is not expected to adversely affect raptors.	Same as Alternative C
Other Land Birds	No Change in Existing Conditions	No Change in Existing Conditions	Restoration of freshwater wetlands and native uplands is expected to benefit a variety of native land birds	Same as Alternative C
Mammals	No Change in Existing Conditions (some mammals could be removed through predator management)	Same as Alternative A	Conversion of non-native uplands to coastal wetlands would eliminate habitat that supports mammals, but impacts to individual species would be minimal and no adverse affects are anticipated.	Same as Alternative C
Reptiles/Amphibians	No Change in Existing Conditions	No Change in Existing Conditions	Conversion of non-native uplands to native habitat could eliminate habitat that supports reptiles and amphibians, but the improved habitat quality following restoration would offset this effect.	Same as Alternative C

**Table 4-6 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, C, or D for the South San Diego Bay Unit**

Resource	Alternative A	Alternative B	Alternative C	Alternative D
<b><i>Wildlife and Fisheries (continued)</i></b>				
Invertebrates	No Change in Existing Conditions	<p>No change in existing conditions for terrestrial invertebrates.</p> <p>With the exception of the few invertebrates that tolerate hypersaline conditions, suitable habitat for native invertebrates is no available within the salt ponds. The changes in the ponds to accommodate additional nesting habitat and pelican platforms would have no adverse effects on brine invertebrates.</p>	<p>Impacts to terrestrial invertebrates due to habitat restoration would be less than significant.</p> <p>The restoration of the salt ponds and Otay River floodplain would provide significant new habitat for many native invertebrates, while habitat for brine invertebrates would be reduced under this alternative.</p>	<p>Impacts to terrestrial invertebrates due to habitat restoration would be less than significant.</p> <p>Breaching the salt ponds could result in short term losses of some invertebrates located immediately adjacent to the ponds, however, normal salinity ranges would be restored within less than a month. The restoration of the salt ponds and Otay River floodplain, which would provide significant new habitat for many native invertebrates, would more than offset these losses.</p> <p>Existing habitat for brine invertebrates would be eliminated, but 44 acres of new habitat is proposed within those ponds designated for brine management.</p>



**Table 4-6 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, C, or D for the South San Diego Bay Unit**

Resource	Alternative A	Alternative B	Alternative C	Alternative D
<b><i>Wildlife and Fisheries (continued)</i></b>				
Fish	No Change in Existing Conditions	The salt ponds do not provide any fish habitat, therefore, installation of pelican platforms and changes in the ponds to provide additional seabird nesting habitat would have no adverse effects on fish.	The restoration of the salt ponds and Otay River floodplain would provide significant new habitat for fish.	Adverse effects to fish in the bay due to levee breaching would be less than significant. Restoration of approx. 650 acres of tidally influenced habitat would provide significant beneficial effects to fish.
<b><i>Endangered &amp; Threatened Species</i></b>				
California least tern	No Change in Existing Conditions	Proposed enhancements in nesting substrate and expansion of available nesting sites would provide moderate benefits.	Improvements in available nesting habitat and increased opportunities for foraging in proximity to nesting areas would provide significant benefits.	Similar to Alternative C, but with greater benefits.
Light-footed clapper rail	No Change in Existing Conditions	No Change in Existing Conditions	Significant benefits would result from the restoration of cordgrass-dominated salt marsh habitat in the salt ponds and the overall restoration of coastal wetlands in the Otay River floodplain.	Similar to Alternative C, but with greater benefits.
California brown pelican	No Change in Existing Conditions	Expanded management in the open waters of the bay could reduce disturbance and public outreach to reduce discarded fishing line accumulation would reduce potential losses from entanglement.	Restoration of Ponds 10 and 11 could impact roosting areas if human disturbance increases on pond levees. Monitoring, added field presents, or the installation of fencing or other barriers would reduce such impacts. Slight foraging benefits would result from improved fish habitat.	Same as Alternative C.

<b>Table 4-6 (continued)</b> <b>Summary of Potential Effects of Implementing</b> <b>Alternatives A, B, C, or D for the South San Diego Bay Unit</b>				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
<b><i>Endangered &amp; Threatened Species (continued)</i></b>				
Western snowy plover	No Change in Existing Conditions	Nesting enhancements, controlling water levels in Pond 20 for nesting, and improving access to foraging areas would provide moderate benefits.	Expanded nesting and <u>improved chick</u> foraging opportunities would provide significantly benefits.	Same as Alternative C.
Pacific green sea turtle	No Change in Existing Conditions	No Change in Existing Conditions	No Change in Existing Conditions	Potential adverse effects to eelgrass, which provides habitat for the sea turtles, would be mitigated in accordance with the South California Eelgrass Mitigation Policy.
<b><i>Solar Salt Production</i></b>				
Continuation of Solar Salt Production	No Change in Existing Conditions	Slight changes in the operation would result from the construction of new nesting habitat. Production would continue.	Slight to moderate changes in the current operation would occur under this alternative. Production would continue within a reduced footprint.	This alternative would result in the elimination of solar salt production within the Refuge Unit.
<b><i>Public Use</i></b>				
Hunting	No Change in Existing Conditions (the Refuge Unit is closed to hunting)	No Change in Existing Conditions	No Change in Existing Conditions	No Change in Existing Conditions
Fishing	No Change in Existing Conditions (Fishing is permitted in the bay.)	No Change in Existing Conditions	Onshore fishing in the bay would be permitted from the northern levee of Pond 11.	No Change in Existing Conditions

**Table 4-6 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, C, or D for the South San Diego Bay Unit**

Resource	Alternative A	Alternative B	Alternative C	Alternative D
<b>Public Use (continued)</b>				
Wildlife Observation/ Photography	No Change in Existing Conditions (Opportunities are available via guided tours and from within the bay.)	No Change in Existing Conditions	Expanded opportunities for wildlife observation would be provided around the perimeter of the bay and along Pond 11's northern levee.	Expanded opportunities for wildlife observation would be provided around the perimeter of the bay and on an interpretive proposed around Pond 28.
Environmental Education	No Change in Existing Conditions (The Habitat Heroes Program)	No Change in Existing Conditions	No Change in Existing Conditions	No Change in Existing Conditions
Environmental Interpretation	No Change in Existing Conditions (no program is currently implement)	No Change in Existing Conditions	No Change in Existing Conditions	Interpretive signage and other elements will be provided along the Bayshore Bikeway, an interpretive trail would be developed around Pond 28, an interpretive program describing the history of hunting on the south bay would be provided seasonally, and an interpretive program to document the significance of solar salt production in the south bay would be developed.
<b>Cultural Resources</b>				
Archaeological	No Change in Existing Conditions	No Change in Existing Conditions	Potential for impacts to subsurface deposits. Mitigation would be implemented if resources are discovered that could be impacted.	Same as Alternative C

<b>Table 4-6 (continued)</b> <b>Summary of Potential Effects of Implementing</b> <b>Alternatives A, B, C, or D for the South San Diego Bay Unit</b>				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
<b><i>Cultural Resources(continued)</i></b>				
Historic	No Change in Existing Conditions	Minor modifications to the South Bay Salt Works would result in no adverse effects to this resource.	Historic character and function of the South Bay Salt Works would be significantly altered under Salt Works Option 2, representing an adverse effect and requiring mitigation.	Eliminating historic salt production would represent an adverse effect and would require mitigation.
<b><i>Socioeconomic</i></b>				
Land Use	No Change in Existing Conditions	No Change in Existing Conditions	No Change in Existing Conditions	No Change in Existing Conditions
Traffic/Parking	No Change in Existing Conditions	No Change in Existing Conditions	Opening the northern levee of Pond 11 to fishing and wildlife observation would increase the parking demand at the Biological Study Area. Coordination with the San Diego County Parks Department would be required.	No increase in parking demands at the Biological Study Area would occur, however, there would be a slight increase in the demand for on-street parking in Imperial Beach associated with new opportunities for wildlife observation and environmental interpretation.
Public Utilities	No Change in Existing Conditions	No Change in Existing Conditions	Coordination with the City of San Diego, <u>SDG&amp;E</u> , or <u>any other utility/agency with facilities in the Otay River floodplain</u> is required prior to restoration to ensure protection of <u>and access to</u> existing sewer, water, or other utilities. The temporary relocation of the bicycle path in Saturn Boulevard may <u>also</u> be required during restoration.	Same as Alternative C

**Table 4-6 (continued)**  
**Summary of Potential Effects of Implementing**  
**Alternatives A, B, C, or D for the South San Diego Bay Unit**

Resource Issue or Concern	Alternative A	Alternative B	Alternative C	Alternative D
<b><i>Socioeconomic (continued)</i></b>				
Access/Education/Recreation	No Change in Existing Conditions	No Change in Existing Conditions	The western segment of the Otay Valley Regional Park Trail would be accommodated if needed; a <u>pedestrian pathway</u> would be constructed adjacent to the Bayshore Bikeway near Ponds 10 and 23 to improve opportunities for wildlife observation. No existing uses would be eliminated.	Accommodates the regional trail and provides a <u>pedestrian pathway</u> to improve access for wildlife observation. No existing uses would be eliminated.
Vectors/Odors	No Change in Existing Conditions	No Change in Existing Conditions	Improved water circulation and new habitat restoration would reduce the availability of breeding areas for mosquitoes; some potential for occasional odors from the restored wetlands.	Same as Alternative C
Economics/Employment	No Change in Existing Conditions	Slight benefits would result from short term contraction work required to implement the nesting enhancements.	Moderate benefits would result from short term contraction jobs, but some of these benefits would be offset by reduced employment at the salt works.	Moderate benefits would result from short term contraction jobs, but these benefits would be offset by the loss of 22 jobs at the salt works
Environmental Justice	No Change in Existing Conditions	No Change in Existing Conditions	Increased accessibility to the Refuge would provide moderate benefits to the surrounding underserved communities	Same as Alternative C

**Table 4-7**  
**Summary of Habitat Changes on the San Diego Bay NWR**  
**under Each Alternative**

<u>Habitat Type</u>	<u>Existing Conditions</u> (approximate acreages)	<u>Proposed Conditions</u> (approximate acreages)
<i><u>Sweetwater Marsh Unit Alternative A</u></i>		
<u>Tidal Wetlands</u>	<u>210 acres</u>	<u>210 acres</u>
<u>Available Nesting Habitat<sup>1</sup> (e.g. least terns, snowy plovers)</u>	<u>32 acres</u>	<u>32 acres</u>
<u>Native Uplands</u>	<u>10 acres</u>	<u>10 acres</u>
<u>Disturbed Uplands and Developed Land</u>	<u>65 acres</u>	<u>65 acres</u>
<i><u>Sweetwater Marsh Unit Alternative B</u></i>		
<u>Tidal Wetlands</u>	<u>210 acres</u>	<u>213 acres</u>
<u>Available Nesting Habitat<sup>1</sup> (e.g. least terns, snowy plovers)</u>	<u>32 acres</u>	<u>32 acres</u>
<u>Native Uplands</u>	<u>10 acres</u>	<u>10 acres</u>
<u>Disturbed Uplands and Developed Land</u>	<u>65 acres</u>	<u>62 acres</u>
<i><u>Sweetwater Marsh Unit Alternative C</u></i>		
<u>Tidal Wetlands</u>	<u>210 acres</u>	<u>244 acres</u>
<u>Available Nesting Habitat (refer to Section 3.4.4.1 Nesting Seabirds for more details)</u>	<u>32 acres</u>	<u>33 acres</u>
<u>Native Uplands</u>	<u>10 acres</u>	<u>30 acres</u>
<u>Disturbed Uplands and Developed Land</u>	<u>65 acres</u>	<u>10 acres</u>

**Table 4-7 (continued)**  
**Summary of Habitat Changes on the San Diego Bay NWR**  
**under Each Alternative**

<u>Habitat Type</u>	<u>Existing Conditions</u> (approximate acreages)	<u>Proposed Conditions</u> (approximate acreages)
<i><u>South San Diego Bay Unit Alternative A</u></i>		
<u>Open Water (subtidal)</u>	<u>850 acres</u>	<u>850 acres</u>
<u>Tidal Wetlands</u>	<u>260 acres</u>	<u>260 acres</u>
<u>Available Nesting Habitat (e.g., least terns, snowy plovers, colonial nesting seabirds)</u>	<u>100 acres</u>	<u>100 acres</u>
<u>Native Uplands</u>	<u>2 acres</u>	<u>2 acres</u>
<u>Freshwater Wetlands</u>	<u>5 acres</u>	<u>5 acres</u>
<u>Existing Salt Ponds (water area only)</u>	<u>960 acres</u>	<u>960 acres</u>
<u>Disturbed Uplands</u>	<u>130 acres</u>	<u>130 acres</u>
<i><u>South San Diego Bay Unit Alternative B</u></i>		
<u>Open Water (subtidal)</u>	<u>850 acres</u>	<u>850 acres</u>
<u>Tidal Wetlands</u>	<u>260 acres</u>	<u>260 acres</u>
<u>Available Nesting Habitat (e.g., least terns, snowy plovers, colonial nesting seabirds)</u>	<u>100 acres</u>	<u>120 acres</u>
<u>Native Uplands</u>	<u>2 acres</u>	<u>2 acres</u>
<u>Freshwater Wetlands</u>	<u>5 acres</u>	<u>5 acres</u>
<u>Existing Salt Ponds (water area only)</u>	<u>960 acres</u>	<u>940 acres</u>
<u>Disturbed Uplands</u>	<u>130 acres</u>	<u>130 acres</u>

**Table 4-7 (continued)**  
**Summary of Habitat Changes on the San Diego Bay NWR**  
**under Each Alternative**

<u>Habitat Type</u>	<u>Existing Conditions</u> (approximate acreages)	<u>Proposed Conditions</u> (approximate acreages)
<i><u>South San Diego Bay Unit Alternative C</u></i>		
<u>Open Water (subtidal)</u>	<u>850 acres</u>	<u>850 acres</u>
<u>Tidal Wetlands</u>	<u>260 acres</u>	<u>520 - 790 acres</u>
<u>Available Habitat for Nesting Birds</u>	<u>100 acres</u>	<u>115 acres<sup>2</sup></u>
<u>Native Uplands</u>	<u>2 acres</u>	<u>42 - 62 acres</u>
<u>Existing Salt Ponds (water area only)</u>	<u>960 acres</u>	<u>520 - 815 acres</u>
<u>Freshwater Wetlands</u>	<u>5 acres</u>	<u>15 - 20 acres</u>
<u>Disturbed Uplands</u>	<u>130 acres</u>	<u>0 acres</u>
<i><u>South San Diego Bay Unit Alternative D</u></i>		
<u>Open Water (subtidal)</u>	<u>850 acres</u>	<u>850 acres</u>
<u>Tidal Wetlands</u>	<u>260 acres</u>	<u>970 - 1,000 acres</u>
<u>Available Habitat for Nesting Birds</u>	<u>100 acres</u>	<u>130 acres<sup>2</sup></u>
<u>Native Uplands</u>	<u>2 acres</u>	<u>42 - 62 acres</u>
<u>Existing Salt Ponds (water area only)</u>	<u>960 acres (commercial salt ponds)</u>	<u>290 acres (converted to managed ponds)</u>
<u>Freshwater Wetlands</u>	<u>5 acres</u>	<u>15 - 20 acres</u>
<u>Disturbed Uplands</u>	<u>130 acres</u>	<u>0 acres</u>

<sup>1</sup> As defined in the 1988 Biological Opinion for this area (*USFWS 1988b*)

<sup>2</sup> This acreage figure takes into account some loss of nesting area on the breached levees, however, the actual width and location of the levee breaches will be determined during step-down planning.



**Table 4-8**  
**Habitat Types on the San Diego Bay NWR**  
**Before and After Implementation of the Preferred Alternatives**

<u>Locations within the San Diego Bay NWR<sup>1</sup></u>	<u>Uplands</u> <u>Existing acreage (proposed acreage)</u>				<u>Wetlands</u> <u>Existing acreage (proposed acreage)</u>			
	<u>Developed Uplands</u>	<u>Disturbed Uplands</u>	<u>Native Uplands</u>	<u>Available Nesting Habitat</u>	<u>Tidal Wetlands</u>	<u>Salt Ponds</u>	<u>Freshwater Wetlands</u>	<u>Managed Water Ponds</u>
<u>Paradise Marsh</u>					<u>36 acres</u> <u>(36 acres)</u>			
<u>Sweetwater Marsh (w/ Marisma de Nacion, Connector Marsh)</u>		<u>3 acres</u> <u>(0 acres)</u>			<u>167 acres</u> <u>(170 acres)</u>			
<u>D Street Fill</u>		<u>22.5 acres</u> <u>(8.5 acres)</u>		<u>32 acres<sup>2</sup></u> <u>(33 acres)</u>	<u>1.0 acres</u> <u>(14 acres)</u>			
<u>Gunpowder Point</u>	<u>8.5 acres</u> <u>(8.5 acres)</u>	<u>22.5 acres</u> <u>(0 acres)</u>	<u>4.5 acres</u> <u>(25 acres)</u>		<u>(2.0 acres)</u>			
<u>F&amp;G Street Marsh</u>		<u>6.0 acres</u> <u>(0 acres)</u>			<u>13 acres</u> <u>(19 acres)</u>			
<u>Salt Ponds (existing conditions do not include levees)</u>				<u>(36 acres)</u>	<u>(650 acres)</u>	<u>960 acres</u> <u>(0 acres)</u>		<u>(274 acres<sup>3</sup>)</u>
<u>Salt Pond Levees</u>				<u>100 acres</u> <u>(96-88 ac.<sup>4</sup>)</u>	<u>(4 -12 ac.<sup>4</sup>)</u>			
<u>Otay River floodplain</u>		<u>125 acres</u> <u>(0 acres)</u>	<u>(40-60 ac.)</u>		<u>10 acres</u> <u>(65-90 ac.)</u>		<u>5 acres</u> <u>(15-20 ac.)</u>	
<u>Upland Terrace south of the Otay River</u>	<u>(0.5 acres<sup>5</sup>)</u>	<u>4.0 acres</u> <u>(0 acres)</u>	<u>(3.0 acres)</u>					

<sup>1</sup> Areas such as the open bay, the mudflats to the north of the salt ponds, and the Otay River channel between the eastern and western ponds are not included, as no changes to these areas are proposed.

<sup>2</sup> As defined in the 1988 Biological Opinion for this area (*USFWS 1988b*)

<sup>3</sup> Acreage figure does not include the pond levees.

<sup>4</sup> The actual width and location of the levee breaches, which when created will reduce to some extent the amount of area available for nesting, will be determined during step-down planning.

<sup>5</sup> A portion of the upland area south of the Otay River would be used to develop a pedestrian trail to accommodate wildlife observation and interpretation.

**Table 4-9**  
**Summary of Native Habitat Changes on the San Diego Bay NWR**  
**under Existing Conditions and the Conditions Proposed Under the Preferred Alternatives**

<u>Habitat Type</u>	<u>Existing Conditions</u> (approximate acreages)	<u>Proposed Conditions under Sweetwater Marsh Unit</u> <u>Alternative C and South San Diego Bay Unit Alternative D</u> (approximate acreages)
<u>Open Water (subtidal)</u>	<u>850 acres</u>	<u>850 acres</u>
<u>Tidal Wetlands</u>	<u>470 acres</u>	<u>1,220 - 1,245 acres</u>
<u>Available Nesting Habitat (e.g. least terns, snowy plovers, colonial nesting seabirds)</u>	<u>132 acres</u>	<u>160 acres</u>
<u>Native Uplands</u>	<u>5 acres</u>	<u>65 - 85 acres</u>
<u>Freshwater Wetlands</u>	<u>5 acres</u>	<u>15 - 20 acres</u>

## 4.9 Cumulative Effects

Cumulative effects can result from the incremental effects of a project when added to other past, present, and reasonably foreseeable future projects in the area. Cumulative impacts can result from individually minor but cumulatively significant actions over a period of time. This analysis is intended to consider the interaction of activities at the Sweetwater Marsh Unit and the South San Diego Bay Unit with other actions occurring over a larger spatial and temporal frame of reference. The interrelated effects of separate actions under the alternatives are also considered.

### 4.9.1 Projects Considered in the Cumulative Effects Analysis

Various projects are currently being planned for implementation in the vicinity of the Refuge. These proposals, which are outlined below, have been considered in this evaluation of cumulative impacts. Also considered in this analysis are other habitat restoration projects currently being considered or implemented along the southern California coast.

#### **Chula Vista Bayfront Master Plan**

The Port and the City of Chula Vista are currently developing plans for the redevelopment of approximately 550 acres of land and water located along the eastern edge of San Diego Bay between the Sweetwater Marsh Unit and the South San Diego Bay Unit. The 550 acres are being considered for the development of a broad range of urban uses, including high- and mid-rise residential development, commercial and office space, hotels, restaurants, major entertainment facilities, public open space, improvements to the existing harbor, and relocation of the existing boat channel in the South Bay.

Issues associated with future redevelopment of this area could include the loss and/or degradation of upland, coastal wetland, and eelgrass habitats, disturbance to wildlife in and adjacent to the bay, changes to water and air quality, effects to cultural resources, increased traffic volumes, changes in the visual quality of the area, and potential effects to human health and minority or low-income populations.

#### **Redevelopment of the West Fairfield Site**

The property located to the west of I-5 and east of the Refuge, between Palomar Street and Main Street, is also being considered for redevelopment. This property currently includes the “Fenton Ponds,” as well as a variety of industrial, commercial, and residential parcels. Potential uses in this area include low and mid-rise residential development and community-serving commercial development. Issues associated with the future development of this area could include direct and indirect disturbance to wildlife, changes to the existing characteristics of the Otay River floodplain, other changes to the existing hydrology in the area, changes to water and air quality, effects to cultural resources, increased traffic volumes, and potential effects to minority and low-income populations.

**Bayshore Bikeway – Western Salt Segment.** The Bayshore Bikeway is a 26-mile bicycle facility that when completed will extend along much of the perimeter of San Diego Bay. The Western Salt Segment consists of a Class 1 bikeway that would extend from about Main Street to 13<sup>th</sup> Street along an existing railroad right-of-way that separates the Otay River floodplain from the salt works. The right-of-way occurs outside the Refuge boundary. Potential issues associated with the future construction of this segment of the bikeway could include disturbance to wildlife, loss or degradation of native habitat, effects to cultural resources, and changes to water quality.

**Otay Valley Athletic Complex.** The City of San Diego is developing plans for an athletic complex to be located on property within the Otay River floodplain that is situated immediately to the south of the Refuge. The facility, which would be constructed on city-owned property, would encompass approximately 20 acres. The complex could include a recreation center, various types of ball fields, a swimming pool, skate park, and other community-related recreational facilities. Potential issues associated with this project could include changes in the hydrological characteristics of the Otay River floodplain, revisions to the boundary of the Multiple Habitat Planning Area, direct and indirect disturbance of wildlife, changes in water quality, increased traffic volumes, effects to cultural resources, and benefits related to recreation.

**City of Imperial Beach Urban Waterfront and Ecotourism Study.** A study is currently being conducted to examine possible strategies for increasing tourism within the City of Imperial Beach. This program could lead to some redevelopment within the community, including portions of the community that abuts the Refuge. If implemented, the program could also generate new visitors to the area. Potential issues that could result from programs generated from this study include direct and indirect disturbance to wildlife, increased traffic volumes, benefits to recreation and environmental interpretation, changes in visual quality, and changes in public access.

**Redevelopment of Pond 20A.** Pond 20A is located to the south of the Refuge and is currently owned by the Port. Preliminary planning for this parcel has been initiated on several occasions. Various uses have been discussed for this area ranging from big-box commercial development to coastal wetland restoration. No plans are currently being reviewed for this parcel. If development were to be considered for a portion of this parcel, potential issues could include changes in the hydrological characteristics of the Otay River floodplain, changes in water quality, loss and/or degradation of wetlands, wildlife disturbance, and changes in visual quality.

**Otay Valley Regional Park.** The Otay Valley Regional Park is a 13-mile linear park, encompassing some 8,000 acres within the Otay River Valley. The park extends from just east of San Diego Bay to the Otay Lake Reservoirs. The Park will provide significant open space and recreational opportunities for residents within the region. A significant component of the park plan is the regional trail system that will provide a loop trail through the Otay River Valley and around the reservoirs. This primary trail will be intercepted by various connecting trails to provide access to recreational areas, overlooks, and adjacent trail systems. Some of the trail system already exists, while other segments are yet to be constructed. Potential issues associated with the implementation of the trail plan include increased erosion and siltation, loss or degradation of native habitat, disturbance to wildlife, and changes in water quality. Many of these issues will be addressed through adherence to the Otay Valley Regional Park Trail Guidelines.

**Otay River Watershed Management Plan and Special Area Management Plan.** The County of San Diego, in cooperation with the Port and the Cities of Chula Vista and Imperial Beach, is currently developing a watershed management plan for the Otay River drainage. The plan involves characterizing the watershed's various resources and land uses, identifying goals and objectives, and assessing and prioritizing threats to existing beneficial uses and natural resources. The plan will also provide a strategy to assure high water quality standards and protect natural aquatic and upland resources in the watershed.

The County of San Diego has also obtained federal funds for the development of a Special Area Management Plan (SAMP) for the Otay River watershed. A SAMP is a comprehensive plan intended to provide for natural resource protection and reasonable economic growth within geographic areas of special sensitivity. This comprehensive planning effort is to be used to assist the federal, state, and local regulatory agencies with their decision making and permitting authority to protect aquatic resources. Approval of these plans by the Corps will result in the issuance of General Permits under the Clean Water Act for projects within the Otay River watershed. The SAMP will identify baseline conditions of the watershed including water quality and the extent of wetlands that can be used in other programs.

The SAMP could facilitate development within the watershed that has the potential to result in issues generally related to urbanization of natural areas, including changes in landform, visual quality, hydrology, and air quality; increases in traffic volumes; loss or degradation of native habitat; and effects to cultural resources.

**San Diego Bay Integrated Natural Resources Management Plan.** This plan, which was sponsored by the U.S. Navy and the Port, presents a long-term management strategy for San Diego Bay. It was prepared to provide direction for the stewardship of the Bay's natural resources, while also supporting the ability of the Navy and Port to meet their missions and continue operating within the Bay. The plan's goal is to "Ensure the long-term health, recovery, and protection of San Diego Bay's ecosystem in concert with the Bay's economic, Naval, recreational, navigational, and fisheries needs. The core strategies of the plan include managing and restoring habitats, populations, and ecosystem processes; planning and coordinating projects and activities so they are compatible with natural resources; improving information sharing, coordination, and dissemination; conducting research and long-term monitoring that supports decision-making; and creating a stakeholder's committee to ensure collaborative, ecosystem-based problem-solving. The plan contains over 1,000 strategies for achieving better management of the bay, including the protection, enhancement, and restoration of the Bay's coastal habitats. An important objective of the plan is to improve the effectiveness and success of mitigation and enhancement projects by building a consensus of prioritized need among regulators and project proponents.

**Coastal Restoration Projects in Southern California.** At least three major restoration projects are currently being implemented or planned for the southern California coast, all located within the Pacific Flyway. These include the Bolsa Chica Lowlands Restoration Project, which is currently under construction, the San Dieguito Wetland Restoration Project, which is currently processing the final permits needed to start construction, and the Tijuana Estuary Tidal Restoration Program (TETRP) II project, which is currently in the initial planning phase.

The Bolsa Chica restoration project is located in Orange County, California adjacent to the City of Huntington Beach. The project proposes to restore approximately 600 acres of tidally influenced habitat and create three new nesting areas on 20 acres within the site for federally-listed endangered species.

The San Dieguito Wetland Restoration Project is located in central San Diego County, California, at the western end of the San Dieguito River Valley. This restoration project proposes to restore approximately 150 acres of intertidal habitat and provide 20 acres of nesting habitat for least terns and western snowy plovers.

The Tijuana Estuary Tidal Restoration Program II (TETRP II) proposes to restore coastal wetlands in southern San Diego County, California at the western end of the Tijuana River Valley. The project, which is the second phase of a larger restoration project, will produce a restoration plan for the remaining 480 acres in Friendship Marsh. When implemented, the TETRP II project is expected to restore habitat values that have been lost and improve tidal exchange within the existing and future marsh. A secondary project objective of this project is to identify options for protecting and enhancing the existing barrier beach. The project will attempt to address sand loss and the associated endangerment of critical habitats when high storm waves surge across the depleted dunes and into the salt marsh.

**Multiple Species Conservation Planning.** Preservation of the San Diego region's biological resources is being addressed through the implementation of regional habitat plans. In southwestern San Diego County, the Multiple Species Conservation Program (MSCP) will preserve a network of habitat and open space in an effort to conserve various species and protect the region's biodiversity. The MSCP is designed to preserve native vegetation and meet the habitat needs of multiple species, rather than focusing preservation efforts on one species at a time.

Several jurisdictions and various special districts are participating in the MSCP including the City of San Diego, City of Chula Vista, and the County of San Diego. These jurisdictions have completed subarea plans that identify core biological resource areas targeted for conservation and describe specific mechanisms for implementing the preserves. To ensure the implementation of the subarea plans and the identified habitat preserves, each jurisdiction has entered into an agreement with the Service and the California Department of Fish and Game. Impacts to biological resources are managed through the various subarea plans. Compliance with the subarea plans along with conformance to federal and state regulations is intended to reduce cumulative adverse impacts to biological resources to below a level of significance.

**Salt Pond Restoration in San Francisco Bay.** Salt pond restoration is also proposed in San Francisco Bay, where 16,500 acres of salt ponds have been acquired to permit management of the ponds to support fish and wildlife. Management changes proposed for the 15,100 acres of salt ponds acquired in south San Francisco Bay include reconfiguring portions of the pond system to maintain the existing shallow open water habitat by allowing bay waters to circulate through the ponds; allowing some ponds to fill with rainwater in the winter and dry out in the summer to provide habitat for migratory shorebirds, including the western snowy plover; controlling water levels in the ponds with different summer and winter water levels to provide habitat for migratory shorebirds and waterfowl; restoring a limited number of ponds to muted tidal or full tidal influence; and allowing salinity levels to rise in some ponds to support specific wildlife populations. Approximately 11,000 acres of existing salt ponds have been retained by Cargill for continued management as commercial solar salt ponds.

The San Francisco Bay salt pond restoration projects would alter the existing conditions in salt ponds located within the Pacific Flyway, potentially affecting the same species that would be affected by changes proposed within south San Diego Bay. Overall, the restoration efforts in San Francisco Bay are expected to result in greater habitat complexity, diversity, and productivity, providing benefits to an array of fish and wildlife, including migratory birds (USFWS and California Department of Fish and Game 2004).

## **4.9.2 Cumulative Effects Analysis**

### **4.9.2.1 Cumulative Effects to the Physical Environment**

The majority of the projects included in the cumulative effects analysis involve proposals that would alter the existing topography and visual appearance of the area. Modifications to the existing landform and conversion of existing uses would represent a significant cumulative change in the overall appearance of the southeastern perimeter of the bay. The restoration proposals described for both Refuge Units would contribute to this significant cumulative effect. Whether this effect is considered adverse would vary depending upon the individual observer. Some adverse effects could be mitigated through appropriate site layout, design, and landscaping.

Several projects included in the cumulative effects analysis would alter the existing flood characteristics within the Otay River floodplain. Analysis conducted for the South San Diego Bay Unit Alternatives C and D indicate that the proposed changes associated with restoration would not adversely affect existing development upstream of the project. However, additional cumulative analysis of this and other reasonably foreseeable projects proposed for the floodplain would be conducted prior to completion of final restoration plans for the Refuge to avoid cumulatively significant changes within the floodplain.

As natural areas are converted to urban development, the acreage of impervious surfaces increases, which in turn increases the volume and velocity of urban runoff and decreases water quality. Some of the projects currently being implemented in the vicinity of the Refuge, including the watershed management plan and SAMP will address the extent to which these adverse effects occur. The alternatives proposed for the Refuge that involve restoration of coastal wetlands would also contribute beneficial effects to regional water quality.

Development of the northern portion of the Chula Vista Bayfront Master Plan area would result in the conversion of land identified by the State as Farmland of Local Importance to urban uses. The only parcels remaining in south coastal San Diego County that support designated farmland include the aforementioned parcel, the Otay River floodplain, and several parcels in the Tijuana River Valley. The conversion of the Bayfront parcel and restoration of the Otay River floodplain parcel (a portion of the South San Diego Bay Unit designated as Prime Farmland) would therefore represent a significant cumulative loss of important farmland in coastal San Diego County.

Impacts from construction, particularly earthmoving operations, although relatively short in duration, would contribute incrementally to the overall concentration of fugitive dust and particulate matter in the air. The contributions from the proposed restoration options are not however considered cumulatively significant.

### **4.9.2.2 Cumulative Effects to Biological Resources**

Many of the projects being considered for implementation in the vicinity of the Refuge could result in disturbance to the wildlife. Some of the public uses proposed on the South San Diego Bay Unit could also result in disturbance to wildlife if appropriate controls such as seasonal restrictions are not imposed. Several alternatives for the Refuge would also result in the restoration of habitat that would provide new habitat areas well removed from human disturbance. Therefore, the incremental adverse effects of introducing some public uses onto the Refuge would be offset by the provision of significant acreage of new habitat areas.

The restoration proposals included within several of the action alternatives evaluated for the Refuge would represent a substantial incremental increase in the amount of intertidal habitat

within San Diego Bay, as well as an incremental increase in the amount of wetland habitat within the Pacific Flyway. Although some wetland areas would be temporarily impacted during habitat restoration (approximately 6 acres in the Otay River floodplain) and Pond 44 (approximately 18 acres) would be filled to provide additional nesting habitat, these impacts would be more than offset by the restoration of approximately 21 acres of intertidal wetlands in the Sweetwater Marsh Unit (13 acres at the D Street Fill, two acres on Gunpowder Point, and six acres at the F&G Street Marsh) and 63 to 88 acres of intertidal wetland restoration in the Otay River flood plain. Therefore, implementation of the CCP would result in a net gain of wetland habitat within San Diego Bay. Additionally, the amount of nesting habitat available for least terns and snowy plovers would increase over existing levels, with 18 to 36 additional acres of nesting habitat proposed within the South San Diego Bay Unit.

The habitat changes within the existing salt pond system both in San Diego Bay and San Francisco Bay would affect migratory birds traveling along the Pacific Flyway. Both projects include components intended to address the needs of a variety of migratory birds, including colonial nesting seabirds and those avian species that tend to forage in higher saline areas supporting brine invertebrates. Overall, these proposals are expected to benefit migratory birds. To ensure that the objectives of these salt pond restoration projects are being met, both projects propose to monitor the actual effects to avian species of restoring, enhancing, or managing salt ponds for fish and wildlife and to implement an adaptive management approach to project implementation.

Of the management alternatives evaluated for the San Diego Bay NWR, implementation of Sweetwater Marsh Unit Alternative C and South San Diego Bay Unit Alternative D would provide the most significant contributions in terms of restored coastal habitat within San Diego Bay. Combined with the other restoration projects under consideration in Southern California, these action alternatives would result in substantial positive cumulative effects to fish and wildlife. These alternatives would also incrementally increase the quality and availability of nesting habitat for the California least tern and western snowy plover; that combined with the other proposals to expand the availability of nesting habitat, would also result in substantial positive cumulative effects to these two listed species.

#### **4.9.2.3 Cumulative Effects to Cultural Resources**

Adherence to the policies and regulations pertaining to the protection of cultural resources would avoid or mitigate any significant adverse effects as a result of implementing any of the action alternatives. However, the elimination of solar salt production, as proposed in Alternative D for the South San Diego Bay Unit, would contribute to the cumulative loss or alteration of historic properties within San Diego County.

#### **4.9.2.4 Social and Economic Environment**

Several of the projects being considered for development in the vicinity of the Refuge could generate significant traffic volumes affecting the local and regional street systems. None of the alternatives considered for the Refuge would contribute cumulatively to localized or regional traffic impacts.

Coordination with the City of San Diego regarding the protection of existing public utilities in the Otay River floodplain would avoid any significant effects; therefore, the no cumulative effects from the implementation of the CCP are anticipated.

Several of the projects proposed in the vicinity of the Refuge would provide new opportunities for recreation. Implementation of Alternatives C or D for the South San Diego Bay Unit would also



provide additional opportunities for recreation, therefore, representing a significant beneficial cumulative effect on the surrounding community and the region.

The alternatives proposed for this Refuge would not result in any incremental increases in the vector population in the South Bay; therefore, no cumulative effects are anticipated. Any increase in odors that could be detected by adjacent residents during restoration would be short in duration and would not represent a cumulative effect.

The implementation of several of the action alternatives for the South San Diego Bay Unit would result in the loss of some or all of the 22 jobs at the South Bay Salt Works. A few of these losses would be offset by the proposed increase in staffing within the Refuge to manage the restored habitats. The enhancement and restoration proposals included in the action alternatives would also result in short term construction jobs that would represent a minor contribution to the regional economy. These incremental changes in the regional work force, although significant to the affected individuals, would not represent a cumulative effect.

The action alternatives, particularly those involving expansion of wildlife dependent recreational uses and improvements to water quality that would occur as a result of wetland restoration, would provide beneficial effects to the residents of the communities that surround the Refuge. In addition, the environmental education programs to be provided would continue to emphasize outreach to underserved communities. These effects would provide incremental positive cumulative effects related to environmental justice.

#### **4.10 Irretrievable and Irreversible Commitment of Resources**

Most management actions identified in this document would require a commitment of funds (refer to Appendix D) that would then be unavailable for use on other Service projects. At some point, commitment of funds to these projects would be irreversible, and once used, these funds would be irretrievable. Non-renewable or non-recyclable resources committed to projects identified in this CCP, such as fuel for Refuge vehicles, supplies used in management or maintenance activities (e.g. herbicide, fencing, signs, etc.), and fuel for construction equipment used to implement enhancement and restoration projects, would also represent irreversible and irretrievable commitments of resources.

Finally, the restoration of the Otay River floodplain would convert up to about 50 acres of land designated by the State as Prime Farmland to intertidal wetlands. This would represent an irreversible and irretrievable commitment of potential farmland to native habitat.

#### **4.11 Short-Term Uses and Long Term Productivity**

An important goal of the National Wildlife Refuge System is to maintain the long-term ecological productivity and integrity of the biological resources on NWRs. This system-wide goal is the foundation for the goals presented in this CCP.

All of the alternatives proposed for the Sweetwater Marsh Unit favor actions that would ensure the long term productivity of the Refuge's resources. Several public uses were considered for evaluation but eliminated from detail study in part because the uses were not found to be compatible with Refuge purposes (refer to Appendix K).

For the South San Diego Bay Unit, some alternatives, such as Alternatives B and D, favor long term productivity over short term uses by minimizing public uses and focusing on endangered species protection and recovery. Alternative D also proposes to displace solar salt production to

increase the overall productivity of the salt ponds, including the bittern and crystallizer ponds that currently provide little in terms of quality habitat for Refuge resources. Restoring long-term productivity to the salt ponds through the reintroduction of tidal circulation would however result in a reduction in the total density of brine invertebrates available within the current system. Alternative C attempts to balance short-term uses (i.e., solar salt production and additional recreational opportunities), while still increasing the long-term productivity of the primary salt ponds.

#### **4.12 Unavoidable Adverse Effects**

None of the alternatives considered for the Sweetwater Marsh Unit would be expected to result in unavoidable adverse environmental effects. Where the potential for such effects has been identified, appropriate mitigation measures have been incorporated into the project scope to reduce the effects to below a level of significance. In addition, monitoring of Refuge resources would be conducted as part of any proposed management action to enable Refuge staff to adapt management policies should unforeseen problems arise.

For the South San Diego Bay Unit, the proposal to restore the Otay River floodplain to native habitat, as described in both Alternative C and Alternative D, would result in an unavoidable adverse effect to agricultural resources. However, the loss of this area to agricultural use is not considered regionally significant, because this area has not been in agricultural production in many years, the size of the affected area is relatively small (approximately 50 acres), and returning this area to protection would have limited economic feasibility. Other potentially significant adverse effects associated with the implementation of the alternatives proposed for the South San Diego Bay Unit would be mitigated to below a level of significance through specific mitigation measures and/or phasing and adaptive management.

# ***Chapter 5 - Compliance, Consultation, and Coordination with Others***

## **5.1 Compliance**

In undertaking a proposed action, the Service must comply with various Federal laws, Executive Orders, regulations, and other guidance pertinent to a Federal action. The Executive Orders and legislative acts listed below have been or will be complied in association with the implementation of the Final CCP.

### **5.1.1 Agency Coordination**

Executive Order 12372, Intergovernmental Review of Federal Programs. Federal agencies are required to provide opportunities for consultation to State and local governments that would be directly affected with a Federal action. *Coordination and consultation is ongoing with State agencies, Tribes, congressional representatives, other Federal agencies, and the local governments that surround these refuges. These entities were also provided with copies of the draft CCP/EIS for review and comment and provided a copy and/or informed of the availability of the Final CCP/EIS.*

### **5.1.2 Human Rights Regulations**

Executive Order 12898, Environmental Justice. Federal agencies are mandated to achieve environmental justice by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. *Environmental justice is addressed in Section 4.7.7 of the CCP/EIS, which states that various management alternatives analyzed for each refuge would not cause disproportionately high and adverse human health impacts in any population, nor would any alternative create a greater burden on low-income households.*

Americans with Disabilities Act of 1990 (ADA). Discrimination is prohibited on the basis of disability in employment, State and local government, public accommodations, commercial facilities, transportation, and telecommunications. *The actions and projects described in the CCP management alternatives would be implemented in compliance with ADA requirements.*

### **5.1.3 Cultural Resources Regulations**

*Section 4.6 of the CCP/EIS describes how the proposed management alternatives would be implemented to comply with the following Executive Order and relevant cultural resources regulations.*

Executive Order 11593, Protection and Enhancement of the Cultural Environment. The Service is required to comply with Section 106 of the National Historic Preservation Act of 1966, as amended, by consulting with Federal and State Historic Preservation Officers when development activities are proposed that would affect the archaeological or historical sites.

Executive Order 13007, Indian Sacred Sites. This order provides for access to and ceremonial use of Indian sacred sites on Federal land used by Indian religious practitioners and directs Federal land managers to avoid adversely affecting the physical integrity of such sacred sites.

Antiquities Act of 1906. This act authorizes the scientific investigation of antiquities on Federal land; prohibits and provides penalties for unauthorized search for or collection of artifacts or other objects of scientific interest; and authorizes the president to establish national monuments and cultural areas on Federal lands.

National Historic Preservation Act of 1966, as amended (PL 89-665; 50 STAT 915; 16 USC 470 et seq.; 36 CFR 800) (NHPA). Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register (Section 106). Section 110(a) sets inventory, nomination, protection, and preservation responsibilities for federally owned cultural properties.

American Indian Religious Freedom Act of 1978 (PL 95-341; 92 STAT 469; 42 USC 1996). This act protects and preserves the right of American Indians to believe, express, and exercise their traditional religions, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

Archaeological Resources Protection Act of 1979, as amended (PL 96-95; 93 STAT 722; 16 USC 470aa-47011) (ARPA). This Act protects archeological resources on public lands.

Native American Graves Protection and Repatriation Act of 1990 (PL 101-601; 25 USC 3001 et seq.) (NAGPRA). Federal agencies are required to provide information about Native American cultural items (e.g., human remains, funerary objects, sacred objects, and objects of cultural patrimony) to parties with standing, such as lineal descendants, culturally affiliated Indian tribes, or Native Hawaiian organizations, and, upon presentation of a valid request, dispose of or repatriate these objects to them.

Curation of Federally-Owned and Administered Archaeological Collections (36 CFR 79). Federal agencies are responsible for ensuring proper care of federally owned and administered archaeological collections, including ensuring that significant prehistoric and historic artifacts, and associated records, are deposited in an institution with adequate long-term curatorial capabilities. Repositories, whether Federal, State, local, or tribal, must be able to provide professional, systematic, and accountable curatorial services on a long-term basis.

#### **5.1.4 Biological Resources Regulations**

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. This order instructs Federal agencies to conserve migratory birds by several means, including the incorporation of strategies and recommendations found in Partners in Flight Bird Conservation Plans, The North American Waterfowl Plan, the North American Waterbird Conservation Plan, and the United States Shorebird Conservation Plan, into agency management plans and guidance documents. *The recommendations and strategies to conserve migratory birds that are contained in the various migratory bird conservation plans have been incorporated into the goals, objectives, and strategies for the two refuges, as presented in Chapter 2 of the CCP/EIS.*

Executive Order 13112, Invasive Species. Federal agencies whose actions may affect the status of invasive species are required to use relevant programs and authorities to prevent, control, monitor, and research such species and coordinate complementary, cost-efficient, and effective activities concerning invasive species by relying on existing organizations already in place that address invasive species issues. *The control of invasive, exotic weeds is proposed in all of the management alternatives described in the CCP/EIS.*

Migratory Bird Treaty Act of 1918, as amended (MBTA). This Act provides protection for bird species that migrate across state and international boundaries. *The Service's Division of Migratory Birds and Habitats Program was consulted during the preparation of the management alternatives and the draft Predator Management Plan, and the actions described in the alternatives proposed for each Refuge Unit were reviewed for consistency with the requirements of the Act.*

Fish and Wildlife Act of 1956, as amended (16 U.S.C. §§742a-742j, not including 742d-742l). This act provides the Secretary of the Interior with authority to protect and manage fish and wildlife resources and provides direction to administer the act with regard to the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment and to maintain and increase public opportunities for recreational use of fish and wildlife resources. *Compatibility determinations were conducted for a variety of wildlife-dependent recreational uses, including fishing, wildlife observation and photography, and environmental education and interpretation.*

Endangered Species Act of 1973, as amended (16 USC 1531 et seq.) (ESA). This act provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend, both through Federal action and by encouraging the establishment of State programs. Section 7 of the ESA requires Federal agencies to insure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat. *A programmatic internal Section 7 consultation was conducted prior to completion of the Final CCP/EIS. The Biological Opinion and the analysis of potential adverse effects to federally listed species, conducted as part of the CCP/EIS (Section 4.5 of the Final CCP/EIS), found that implementation of the management alternatives described in the CCP/EIS would not adversely affect listed species.*

### **5.1.5 Land and Water Use Regulations**

Executive Order 11988, Floodplain Management. Federal agencies are prohibited from contributing to the "adverse impacts associated with the occupancy and modification of floodplains" and the "direct or indirect support of floodplain development." In addition, before proposing, conducting, supporting, or allowing an action in a floodplain, each agency is to determine if planned activities will affect the floodplain and evaluate the potential effects of the intended actions on its functions. *The potential upstream effects of restoring wetlands within the Otay River floodplain are evaluated in Section 4.2.2.3.3 and Appendix I of the CCP/EIS. Based on this analysis, the potential for flooding upstream of the South San Diego Bay Unit would not increase as a result of restoration, and in some cases, flood elevations would be expected to be somewhat lower. Additional analysis would be conducted when more specific restoration plans are developed for the South San Diego Bay Unit.*

Executive Order 11990, Protection of Wetlands. Each agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands when conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities. *All of the management alternatives described in the Final CCP/EIS would result in the protection of the existing wetlands within each Refuge Unit. Some of the alternatives also include proposals to improve and/or restore current wetland habitat values.*

Executive Order No. 12996, Management and General Public Use of the National Wildlife Refuge System. This order directs the Secretary of the Interior to recognize compatible wildlife-

dependent recreational activities involving hunting, fishing, wildlife observation and photography, and environmental education/interpretation as priority general public uses on the refuge system. *As part of the development of the CCP, the Service completed compatibility determinations for various wildlife-dependent recreational activities, including existing uses and new uses suggested by the public.*

Refuge Recreation Act of 1962, as amended. This act authorized the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. *The compatibility determinations prepared as part of the development of the CCP included an evaluation of whether or not the proposed use was compatible with the purposes for which the particular refuge was established.*

National Wildlife Refuge System Act of 1966, as amended (16 USC 668dd-668ee). This act requires that refuges are managed as a national system of related lands, waters, and interests for the protection and conservation of our Nation's wildlife resources. Any use of a refuge is permitted provided "such uses are compatible with the major purposes for which such areas were established." *The CCP was prepared in accordance with this act and complies with the requirement that only compatible uses be permitted on a refuge.*

Coastal Zone Management Act of 1972 (16 USC 1451-1464). This act requires that all Federal actions proposed in the coastal zone be conducted in a manner consistent with the approved coastal zone management plan. *Following completion of the Final CCP/EIS, a request for a consistency determination will be submitted to the California Coastal Commission.*

Federal Water Pollution Control Act of 1948, as amended (33 U.S.C. 1251 - 1376; Chapter 758; P.L. 845; 62 Stat. 1155) (Clean Water Act). This act established the basic structure for regulating discharges of pollutants into the waters of the United States. Section 402 of the act established the National Pollutant Discharge Elimination System (NPDES) to authorize EPA issuance of discharge permits (33 U.S.C. 1342) and Section 404 authorized the U.S. Army, Corps of Engineers to issue permits for the discharge of dredged or fill material into navigable waters at specified disposal sites (33 U.S.C. 1344). *Prior to the implementation of any wetland restoration projects within the Refuge, the appropriate permits related to the Clean Water Act would be obtained. Best Management Practices would be implemented during restoration to avoid or minimize the potential for adverse effects to water quality in San Diego Bay and adjacent wetlands.*

### **5.1.6 Tribal Coordination**

Executive Order 13175, Consultation and Coordination with Indian Tribal Governments. This order requires Federal agencies to implement an accountable process to ensure meaningful and timely input by tribal officials as policies are developed that have tribal implications. *Twenty-two Federally-recognized Tribes and other tribal organizations were contacted to solicit comments and initiate consultation with respect to the development of the draft CCP/EIS and various proposed actions evaluated within the document.*

### **5.1.7 Wilderness Review**

Wilderness Act of 1964 (16 U.S.C. 1131-1136, 78 Stat. 890). The Wilderness Act of 1964 directed the Secretary of the Interior, within 10 years, to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within National Wildlife Refuge and National Park Systems and to recommend to the President the suitability of each such area or island for inclusion in the National Wilderness Preservation System. Refuge planning policy requires a wilderness review concurrent with the CCP process [602 FW 3(1)(c)]. The wilderness review process consists

of three phases: inventory, study, and recommendation. The inventory is a broad look at the refuge to identify lands and waters that meet the minimum criteria for wilderness. The study evaluates all values (ecological, recreational, cultural), resources (e.g., wildlife, water, vegetation, minerals, soils), and uses (management and public) within the Wilderness Study Area. The findings of the study determine whether or not the area should be recommended for designation as wilderness. *The Service lands and waters within the planning area have been inventoried and no areas were found that meet the eligibility criteria for a Wilderness Study Area as defined by the Wilderness Act. Therefore, potential wilderness designation of lands and waters within the San Diego Bay NWR is not analyzed further in the CCP. The results of the wilderness inventory are documented in Appendix N.*

## **5.2 Public Involvement, Consultation, and Coordination**

### **5.2.1 Public Outreach Summary**

The following summarizes the public outreach that has occurred for this CCP, including initial scoping meetings, public workshops, posting information on the Refuge Complex website, interagency meetings, planning update mailings, Federal Register notices, and an overview of the topics discussed or comments received. The CCP distribution list is provided in Appendix B and a summary of the public comments provided during initial scoping and at the public workshops is provided in Appendix E.

#### **5.2.1.1 Initial Scoping Meetings**

Provided below is a summary of two scoping meeting held to initiate the CCP process.

**Date and Location of the Meeting:** Monday, July 10, 2000 (7:00-9:00 PM) at the Marina Vista Center in Imperial Beach, California.

**Notification Process:** Federal Register, Planning Update #1 (mailing list includes >1,000 individuals, agencies, and organizations), Letter to Affected Federal, State and Local Agencies, Press Release.

**Purpose:** Initial scoping meeting to solicit public comment and participation in the process.

**Format:** Welcome and overview presentation followed by an open house style format with various topic tables and Service staff available to answer questions and record comments. Table topics included: general information about Refuges, the CCP process, public use, refuge operations, and wildlife management and endangered species.

**Number of Participants (excluding Service staff):** 45

**Audience:** Public, Government Agency Representatives, Local Elected Officials, and Non-governmental Organizations.

**Topics Discussed:** Future land acquisitions, boundary expansion, public use, research, bay-wide coordination of interpretive signage, species inventories, existing habitat preservation, adaptive management, habitat restoration, endangered species, invasive species, and predator control.

**Follow Up:** A letter, dated September 20, 2000, was distributed to all participants to invite them to the next set of public workshops.

**Date and Location of the Meeting:** Tuesday, July 11, 2000 (1:30–3:30 PM) at the Chula Vista Nature Center Auditorium, Chula Vista, California.

**Notification Process:** Federal Register, Planning Update #1, Letter to Affected Federal, State and Local Agencies, Press Release.

**Purpose:** Initial scoping meeting to solicit public comment and participation in the process.

**Format:** Same format as described above.

**Number of Participants (excluding Service staff):** 24

**Audience:** Public, Government Agency Representatives, and Non-governmental Organizations.

**Topics Discussed:** Similar to above, as well as procedural issues related to the make up of the CCP team, adjacent development proposals, and planning for the Stewardship Project.

**Follow Up:** Same as above.

### **5.2.1.2 Public Meetings**

Provided below is a summary of the various public workshops held to address specific issues related to the CCP.

**Date and Location of the Meeting:** Thursday, September 28, 2000 (6:30-9:00 PM) Imperial Beach Community Room, Imperial Beach, California.

**Notification Process:** Postcard (using updated mailing list), Press Release, Letter to participants of the initial scoping meetings, Announcement in the San Diego Union Tribune.

**Purpose:** Public Use Workshop

**Format:** Opening presentation, followed by a facilitated question and comment period.

**Number of Participants (excluding Service staff):** 23

**Audience:** Public, Government Agency Representatives, and Non-governmental Organizations.

**Topics Discussed:** Public access, trails, viewing areas, hunting, fishing, boating, dog trials, environmental education, and interpretation.

**Follow Up:** A letter, dated October 13, 2000, was distributed to all participants that included a reminder about the next workshop and provided a summary of the comments received at the September 28 meeting.

**Date and Location of the Meeting:** Thursday, November 2, 2000 (6:30-9:00 PM) Chula Vista City Hall Conference Room, Chula Vista, California.

**Notification Process:** Postcard (using updated mailing list), Follow-up Notice to Past Workshop Participants, Press Release, Article in the San Diego Union Tribune.

**Purpose:** Wildlife Management/Restoration Workshop

**Format:** Formal presentation, followed by a facilitated question and comment period.

**Number of Participants (excluding Service staff):** 30

**Audience:** Public, Government Agency Representatives, and Non-governmental Organizations.

**Topics Discussed:** Priorities for habitat management, the need to develop a baseline data base for each refuge, predator control, invasive species, maintaining existing habitat values on the salt pond levees for nesting seabirds, brine invertebrates, water quality, and coordination of refuge planning with other habitat planning in the region.

**Follow Up:** A letter, dated December 19, 2000, was sent to the participants thanking them for their involvement and providing a summary of the comments heard at the November 2 workshop.

**Date and Location of the Meeting:** Thursday, March 1, 2001 (6:30-9:00 PM) Imperial Beach Community Room, Imperial Beach, California.

**Notification Process:** Postcard (using updated mailing list), Follow-up Notice to Past Workshop Participants, Press Release, Announcement in the San Diego Union Tribune.

**Purpose:** Refuge Goals/Objectives and Salt Works Restoration Workshop

**Format:** Formal presentation, followed by a question and comment period.

**Number of Participants (excluding Service staff):** 54



**Audience:** Public, Government Agency Representatives, Local Elected Officials, and Non-governmental Organizations.

**Topics Discussed:** Need for hydrologic studies, predator control, seabird nesting, contaminants, restoration phasing, endangered species, and long-term maintenance.

**Follow Up:** The information presented at the workshop was posted on the Refuge website and additional comments were solicited.

**Date and Location of the Meeting:** Tuesday, May 22, 2001 (6:30-9:00 PM) Imperial Beach Community Room, Imperial Beach, California.

**Notification Process:** Mailer (using updated mailing list), Press Release, Announcement in the San Diego Union Tribune.

**Purpose:** Restoration Workshop

**Format:** Formal presentation, followed by a public comment period.

**Number of Participants (excluding Service staff):** 25

**Audience:** Public, Government Agency Representatives, and Non-governmental Organizations.

**Topics Discussed:** Avoidance of existing high value habitat during restoration, maintaining a brine invertebrates for migratory birds, restoration of tidal exchange in some ponds, protection of endangered species, phase restoration, and enhancement of habitat for seabird nesting.

**Follow Up:** Continued to encourage comments through the Refuge's webpage.

**Date and Location of the Meeting:** Thursday, June 21, 2001 (6:30-9:00 PM) Chula Vista City Council Chambers, Chula Vista, California.

**Notification Process:** Mailer (using updated mailing list), Press Release.

**Purpose:** Public Use Workshop

**Format:** Formal presentation, followed by a facilitated public comment period.

**Number of Participants (excluding Service staff):** 50

**Audience:** Public, Government Agency Representatives, and Non-governmental Organizations.

**Topics Discussed:** Refuge policies related to public use, existing public uses, potential public uses on the refuges, hunting, fishing, dog trials, boating, and public access on the refuges.

**Follow Up:** Planning Updates # 2 and # 3 addressed the topic of public use.

**Date and Location of the Meeting:** Thursday, June 2, 2005 (6:30-8:00 PM) Chula Vista City Council Chambers, Chula Vista, California.

**Notification Process:** Planning Update #6, Press Release.

**Purpose:** Public Workshop to provide an overview of the forthcoming draft CCP/EIS.

**Format:** Formal presentation, followed by a request for questions and general comments.

**Number of Participants (excluding Service staff):** 28

**Audience:** Public, Government Agency Representatives, and Non-governmental Organizations.

**Topics Discussed:** Overview of the management alternatives evaluated in the draft CCP/EIS, description of the format and general content of the draft CCP/EIS, information on how to obtain a copy of the draft CCP/EIS for review and contact information for providing comments on the draft CCP/EIS.

**Follow Up:** Draft CCP/EIS and Planning Update #7 were issued on July 22, 2005.

**Date and Location of the Meeting:** Wednesday, August 31, 2005 (6:30-8:00 PM) Chula Vista City Council Chambers, Chula Vista, California.

**Notification Process:** Planning Update #7, Federal Register Notice, Press Release.

**Purpose:** Public Meeting to discuss the draft CCP/EIS and receive verbal comments regarding the draft CCP/EIS.

**Format:** Formal presentation, followed by a request for public comments.

**Number of Participants (excluding Service staff):** 22

**Audience:** Public, Government Agency Representatives, and Non-governmental Organizations.

**Topics Discussed:** Overview of the CCP/EIS, information on how to obtain a copy of the draft CCP/EIS for review and contact information for providing comments on the draft CCP/EIS. Public comments were also received.

**Follow Up:** Preparation of responses to comments for public review as part of the Final CCP/EIS.

### **5.2.1.3 Interagency Coordination Meeting**

An interagency meeting was also held to provide various local, state, and federal agencies with an overview of the CCP. The specifics of that meeting are presented below.

**Date and Location of the Meeting:** Thursday, September 7, 2000 (1:00-4:00 PM) Imperial Beach Community Room, Imperial Beach, California.

**Notification Process:** Letter Invitation to Participants.

**Purpose:** Interagency Coordination Meeting

**Format:** Welcome and overview presentation, open discussion among agency representatives, public comment.

**Number of Participants (excluding Service staff):** 16 agency representatives, and 6 members of the public.

**Audience:** Public agencies representatives, members of the public were present and some provided comment during a public comment period.

**Topics Discussed:** Overview of the CCP process, review of the role of each agency in the process, and overview of interim refuge goals.

### **5.2.1.4 Planning Updates**

**Date:** June 2000, Planning Update #1

**Purpose:** To announce the initiation of the CCP process, invite the public to participate, publicize the dates of the initial scoping meetings, present an overview of the NWRS and the Sweetwater Marsh NWR and the South San Diego Bay Unit, and provide public contact information.

**Number of Recipients:** >1,000 (also posted on the Refuge website)

**Date:** October 2001, Planning Update #2

**Purpose:** To provide information regarding refuge goals, restoration planning, and public use and to briefly summarize the public participation process.

**Number of Recipients:** >1,000 (also posted on the Refuge website)

**Date:** March 2002, Planning Update #3

**Purpose:** To address public use issues, particularly waterfowl hunting.

**Number of Recipients:** >1,000 (also posted on the Refuge website)

**Date:** July 2003, Planning Update #4

**Purpose:** To describe the alternatives to be analyzed in the draft CCP/EIS.

**Number of Recipients:** >1,000 (also posted on the Refuge website)

**Date:** April 2005, Planning Update #5

**Purpose:** To announce the Refuge name change and describe the public review process.

**Number of Recipients:** >1,000 (also posted on the Refuge website)

**Date:** May 2005, Planning Update #6

**Purpose:** To provide notification that a public workshop had been scheduled for June 2, 2005 to preview the draft CCP/EIS.

**Number of Recipients:** >1,000 (also posted on the Refuge website)

**Date:** July 2005, Planning Update #7

**Purpose:** To announce the beginning of the public comment period for the San Diego Bay NWR draft CCP/EIS; to provide information on reviewing and providing comments on the draft, and to announce a public meeting to be held on August 30, 2005 to discuss the draft CCP/EIS and provide an opportunity for public comments.

**Number of Recipients:** >1,000 (also posted on the Refuge website)

#### **5.2.1.5 Federal Register Notices**

**Date of Notice:** June 23, 2000, listing in the Federal Register

**Purpose:** Notice of Intent to Prepare a Comprehensive Conservation Plan and Associated NEPA Document

**Audience:** National

**Contents of the Notice:** Public notice of initiation of the planning process for the refuges, solicitation of written comments, and announcement of public workshops/open houses.

**Date of Notice:** April 22, 2002, listing in the Federal Register

**Purpose:** Revised Notice of Intent to Prepare a Comprehensive Conservation Plan and Associated NEPA Document

**Audience:** National

**Contents of the Notice:** Public notice of the Service's intent to prepare an Environmental Impact Statement in association with the CCP.

**Date of Notice:** July 22, 2005, listing in the Federal Register

**Purpose:** Notice of Availability of a Draft Comprehensive Conservation Plan and Environmental Impact Statement for the San Diego Bay NWR

**Audience:** National

**Contents of the Notice:** Announcement that the draft CCP/EIS for the San Diego Bay NWR was available for public review and comment. The notice listed the public libraries and other public locations where the draft CCP/EIS was available for review, as well as providing the CCP website where the document could be reviewed on line. Information about the August 31 public meeting and contact information for providing comments was also provided.

#### **5.2.1.6 Tribal Consultation and Coordination**

In February 2002, a letter was sent to 22 Tribal governments and other tribal organizations regarding the CCP process and encouraging participation in the development of the CCP. All Planning Updates and public notices related to the CCP process were also provided. In June 2004,

a second letter was sent to provide a CCP update, summarize the management alternatives being evaluated in the draft CCP/EIS, and encourage involvement in the process.

#### **5.2.1.7 Consultation and Coordination with Others**

Since scoping was initiated for this CCP in June 2000, the CCP planning team has consulted with various agencies, outside consultants, and academia to ensure a comprehensive evaluation of the various management alternatives presented in the draft CCP/EIS. The team has also coordinated with other Federal, State, and local agencies, non-governmental organizations, and the public to keep them updated on the progress of the CCP and the issues being considered during the development of the CCP. Some of the entities that have been involved in the process include:

- California Department of Fish and Game – An invitation to participate in the CCP process was formally extended to the Department in a letter dated August 10, 2000. The Department has assisted in issues related to restoration and public use. A meeting was held with Department staff on December 19, 2005 to review the management alternatives evaluated in the draft CCP/EIS.
- NOAA Fisheries – This agency was represented as several public workshops, the South Bay interagency coordination meeting, and provided technical assistance in the evaluation of specific restoration proposals.
- U.S. Navy - The Service coordinated with the Navy on several occasions to address issues related to public use. In addition, the Navy provided invaluable data regarding the resources in San Diego Bay and participated in the South Bay interagency coordination meeting. A meeting to discuss the Navy's comments regarding the draft CCP/EIS was held on January 31, 2006.
- Regional Water Quality Control Board – Several meetings have been held with staff from the Regional Board to review the potential effects of levee breaching on water quality within San Diego Bay.

The CCP planning team has also coordinated with the U.S. Coast Guard, California State Lands Commission, Unified Port of San Diego, San Diego County Airport Authority, County of San Diego, Cities of Chula Vista, Coronado, Imperial Beach, National City, and San Diego, South Bay Salt Works, and others. The expertise of agency, university, and consulting restoration biologists, wildlife biologists, entomologists, and others were sought to assist the team in evaluating issues related to salt pond restoration, brine invertebrate production, and coastal salt marsh restoration. In addition, using funds provided by the Service's Coastal Program Philip Williams and Associates, Ducks Unlimited, Inc, and Everest International Consultants, Inc. were retained to assist in hydrologic modeling and restoration engineering.

### **5.3 Acknowledgements**

Over one hundred people and numerous non-governmental organizations have contributed in some way to the development of this CCP. Although it is not possible to name them all, we would like to acknowledge the time and energy that they have expended to express their views and comments, support the process, and appreciate and enjoy the resources included within these Refuge Units.

The following individuals generously donated their time to assist the CCP Planning Team in evaluating various aspects of habitat management and restoration:

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Elizabeth Copper  
Barbara Hemmingsen

Keith Merkel  
Chris Nordby  
Robert Patton

Wes Maffei  
Dr. Richard Zembal

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We would also like to acknowledge the many Federal, State, and local agency staff members and their consultants who readily provided information and input when approached by Service staff.

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Name	Contributions	Degree	Years of Experience
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