

Draft
SS Cape Mohican Oil Spill
Restoration Plan and
Environmental Assessment

Prepared by the SS Cape Mohican Trustee Council:

United States of America

National Park Service

Fish and Wildlife Service

National Oceanic and Atmospheric Administration

State of California

Department of Fish and Game

Department of Parks and Recreation

September 10, 2001

PREFACE

I. Public Meeting

There will be a public meeting held on this draft Restoration Plan/Environmental Assessment (RP/EA) in:
San Francisco, California

Date: September 26, 2001

Time: 7:00 p.m. – 9:00 p.m.

Location: Building 201, Fort Mason, Golden Gate National Recreation Area - Park Headquarters
(Intersection of Franklin and Bay Streets)

The Trustees will provide a general overview of the plan and accept both oral and written comments on the plan at that time. Persons attending the Public Workshop may present oral and/or written comments on the draft RP/EA or present additional restoration projects. This document can also be reviewed at the following Websites: www.dfg.ca.gov/Ospr/index.html and www.darcnw.noaa.gov/mohicn.htm.

II. Comments

Following a public notice, this draft RP/EA will be available to the public for a 45-day comment period beginning September 10, 2001 and ending October 25, 2001. The Trustee Council will review all public comments received during the review period and before completion of the final RP/EA. In addition, public comments will be included in the Administrative Record.

Comments should be submitted to:

Mr. Dan Welsh
U.S. Fish and Wildlife Service
California-Nevada Operations Office
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Sacramento, California 95825

Comments can also be submitted by e-mail at: daniel_welsh@fws.gov

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DISTRIBUTION

LIST OF ACRONYMS

BCDC	San Francisco Bay Conservation and Development Commission
Caltrans	California Department of Transportation
CCC	California Coastal Conservancy
CDFG	California Department of Fish and Game
CDPR	California Department of Parks and Recreation
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COE	U.S. Army Corps of Engineers
CRMP	Coordinated Resources Management Process
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DOC	U.S. Department of Commerce
DOI	U.S. Department of the Interior
DRMR	Duxbury Reef Marine Reserve
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FMR	Fitzgerald Marine Reserve
FMSH	Farallones Marine Sanctuary Association
FONSI	Finding of No Significant Impact
FPNHS	Fort Point National Historic Site
GFNMS	Gulf of the Farallones National Marine Sanctuary
GGBR	Golden Gate Biosphere Reserve
GGNRA	Golden Gate National Recreation Area
ICS	Incident Command System
IFO	Intermediate Fuel Oil
MHHW	Mean High High Water

MLT	Mean Low Tide
MOU	Memorandum of Understanding
MARAD	Maritime Administration
NCP	National Contingency Plan
NMS	National Marine Sanctuaries
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRD	Natural Resource Damage
NRDA	Natural Resource Damage Assessment
NWR	National Wildlife Refuge
OPA	Oil Pollution Act of 1990
OSPR	Office of Spill Prevention and Response
PRBO	Point Reyes Bird Observatory
PRNS	Point Reyes National Seashore
PSU	Practical salinity units
RP/EA	Restoration Plan/Environmental Assessment
SOHP	State Office of Historic Preservation
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1.0 INTRODUCTION

1.1 Purpose

This draft Restoration Plan and Environmental Assessment (draft RP/EA) presents information to the public regarding the affected environment, the determination of natural resource injuries, and proposed restoration actions to compensate for natural resource injuries and lost human-use caused by the October 28, 1996, SS Cape Mohican oil spill. The oil spill adversely affected resources in San Francisco Bay (Bay) and along the California coast.

This draft RP/EA is intended to comply with the Oil Pollution Act (OPA) of 1990, 33 U.S.C. 2701, et seq. This document also serves, in part, as the trustee agencies' compliance with the National Environmental Policy Act (NEPA), 42 U.S.C. 4321–4370d, the California Environmental Quality Act (CEQA), Public Resources Code §§ 21000-21178.1; and their implementing regulations, to the extent that they apply. The Trustees also intend to use the final RP/EA in place of the “Initial Study” requirement of CEQA.

The purpose of Restoration Planning is to evaluate the potential injuries to natural resources, and natural resource services, and use that information to determine the need for and scale of restoration actions. Natural resource services are the ecological and public services that natural resources provide. Examples of ecological services are the services that one natural resource provides for another, such as food and nesting habitat. Public services include such things as nature photography, education, fishing, swimming, and hiking.

Restoration Planning provides the link between injury and restoration and has two basic components: (1) injury assessment and (2) restoration selection. The goal of injury assessment is to determine the nature and extent of injuries to natural resources and services, thereby providing a factual basis for evaluating the need for, type of, and scale of restoration actions. Consistent with the OPA, the goal of the proposed restoration actions presented in this draft RP/EA is to make the environment and the public whole for injuries to, or lost use of, natural resources and services resulting from the Cape Mohican oil spill. This will be accomplished through the restoration, rehabilitation, replacement, or acquisition, collectively referred to as restoration, of equivalent natural resources and services. The specific goals for this incident are to restore the following natural resources affected by the oil spill: birds, fisheries and water quality, sandy shorelines, wetlands/mudflats, and rocky intertidal habitat. In addition, restoration projects to compensate for the lost use of public areas and public services will be implemented. Additional environmental compliance may be required prior to actual implementation of the proposed projects described herein.

Restoration for each of these habitats will be accomplished by implementing several restoration projects at specific locations throughout the Bay and the California coast. The replacement of lost human-uses, primarily lost recreation uses, will be accomplished by enhancing the experience and use of natural resources at public parks. This draft RP/EA provides a description of each of the proposed restoration projects including the objectives, success criteria, monitoring, and environmental consequences.

1.2 Overview/Summary of Incident

On October 28, 1996, at approximately 3:30 p.m., the SS Cape Mohican, a 725-foot Maritime Administration (MARAD) vessel, discharged an estimated 96,000 gallons of Intermediate Fuel Oil (IFO) 180, a heavy bunker fuel oil, into a floating dry dock during routine maintenance at the San Francisco Drydock Shipyard. Approximately 40,000 gallons of fuel escaped Drydock #2 and spilled into the Bay at

Pier 70. The spill is believed to have occurred when an opened valve discharged stored fuel during the transfer of oil from a stabilization tank.

At the time of the discharge, the wind was blowing at 14 knots from the south-southwest; shortly after the discharge, the wind speed increased to 25-knot gusts and it began to rain heavily. Dispersed by an early-season storm, the discharged oil spread through portions of San Francisco Bay. Oil spread from Pier 70 south to offshore of Hunter's Point and north into the central Bay to the Richmond-San Rafael Bridge, making landfall at Alcatraz, Yerba Buena, Treasure, and Angel islands. The Tiburon Peninsula and San Francisco waterfront were also oiled. The oil traveled outside the Golden Gate, oiling beaches as far north as Drakes Beach in the Point Reyes National Seashore (PRNS) and as far south as Pillar Point (Figure 1).

Oil spill response organizations and contractors conducted on-water and shoreline cleanup actions. Management of the spill response operations was directed by an Incident Command System (ICS), which included the United States Coast Guard (USCG), San Francisco Drydock, and California Department of Fish and Game's (CDFG) Office of Spill Prevention and Response (OSPR). The ICS staff included representatives from the USCG, CDFG-OSPR, United States Fish and Wildlife Service (USFWS), National Park Service (NPS), National Oceanic and Atmospheric Administration (NOAA), Gulf of the Farallones National Marine Sanctuary (GFNMS), California Department of Parks and Recreation (CDPR), Bay Area Conservation and Development Commission (BCDC), California Conservation Corps (CCC), and local government agencies.

1.3 Natural Resource Trustees and Authorities

Both federal and California statutes establish liability for natural resource damages to compensate the public for the injury, destruction, and loss of such resources and their services resulting from oil spills. Natural resource trustees are authorized to act on behalf of the public under state and federal statutes to assess and recover natural resource damages and to plan and implement actions to restore natural resources and resource services injured or lost as a result of a discharge of oil. The Trustees are following guidance concerning Restoration Planning and implementation contained in the following:

- Oil Pollution Act (OPA) of 1990 (*33 U.S.C. 2701 et seq.*)
- Natural Resource Damage Assessment Regulations under the Oil Pollution Act of 1990 (*15 CFR Part 990*)
- National Park System Resource Protection Act (*16 U.S.C., Section 19jj-4*)
- National Oil and Hazardous Substances Pollution Contingency Plan (*NCP; 40 CFR 300.600*)
- Executive Order 12777 (implements Section 311 of the Water Pollution Control Act of 1972 and OPA)
- The Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (*California Government Code Section 8670.1 et seq.* and *California Public Resources Code, Division 7.8*)

This draft RP/EA was prepared jointly by the United States Department of the Interior (DOI), represented by the National Park Service and the United States Fish and Wildlife Service; the Department of Commerce (DOC), represented by the National Oceanic and Atmospheric Administration; and the State of California, represented by the Department of Fish and Game Office of Spill Prevention and Response and the Department of Parks and Recreation. These agencies formed a "Trustee Council" to work cooperatively and evaluate natural resource injuries, assess damage, and identify the potential restoration

actions presented in this document. A Memorandum of Understanding (MOU) between these federal and state Trustees was entered into to ensure coordination and cooperation in restoring natural resources injured as a result of the Cape Mohican oil spill.

1.4 Coordination with Responsible Parties

The OPA natural resource damage (NRD) regulations provide for the Trustees to invite the Responsible Party to participate in the natural resource damage assessment process. Although the Responsible Party may contribute to the process in many ways, final authority to make determinations regarding injury and restoration rests solely with the Trustees.

On November 8, 1996, the Trustees for the Cape Mohican oil spill invited the responsible parties to participate in a cooperative natural resource damage assessment (NRDA). The Maritime Administration, owner of the vessel, provided funding to the Trustees to undertake studies and related activities. The other responsible party, San Francisco Drydock, Inc., accepted the invitation, but expressed concerns related to its potential share of damage assessment costs. Although an “Agreement for an Assessment of Injuries” was developed, it was not implemented because the parties were able to negotiate an early resolution of the NRD claim. Nevertheless, the Trustees shared data related to the damage assessment with the responsible parties.

1.5 Settlement of Natural Resources Claims

The United States and State of California entered into a consent decree with the responsible parties that resolved claims asserted by both governments. The terms of the settlement are set forth in that consent decree entered by the United States District Court for the Northern District of California (a copy is located in the Administrative Record). The settlement covered claims for oil spill response costs; natural resource damage assessment costs; civil penalties, damages for injuries to birds, mammals, shoreline and aquatic habitats; and lost human-use of natural resources.

The consent decree required the Trustee Council to develop a Restoration Plan for the natural resources and resource services that were affected by the oil spill, and to provide an opportunity for public input on the draft RP/EA. This document addresses that requirement by providing the draft RP/EA to the public for input.

A total of \$3,625,000 was awarded to the Trustees under the consent decree for the design, implementation, permitting, monitoring, and oversight of restoration projects. In accordance with the settlement consent decree, settlement funds are to be allocated towards the restoration resource categories injured as a result of the oil spill (Table 1).

Table 1. Allocation of settlement award funds according to type of restoration project.

Resource Category	Amount of allocation (\$)
Wetland habitat	400,000
Sandy shoreline & rocky intertidal habitat	500,000
Bird restoration	800,000
Fisheries and water quality	425,000
Lost and diminished human-uses	1,030,000
Restoration planning	470,000
Total	3,625,000

1.6 Public Participation

Public review of a draft RP/EA is an integral aspect of the OPA Restoration Planning process (33 U.S.C. § 2706 [C][5]). The NRDA regulations, which implement the trustee provisions of OPA, provide for the Trustees to solicit the public to comment on a draft RP/EA and consider the comments during the preparation of a Final RP/EA (15 C.F.R. 990.55[c]). In addition, public review of this draft RP/EA is consistent with NEPA as amended (42 U.S.C. 4321 *et seq.*) and its implementing regulations (40 C.F.R. Parts 1500–1508). It is also consistent with the requirement of CEQA (*Pub. Res. Code Sections 21000-21177.1*).

The initial action taken to involve the public in the restoration planning process for this spill was the public scoping process held during the spring 1999. The Trustee Council prepared and circulated a public scoping document, which described injuries associated with the oil spill and summarized potential restoration projects that were identified during settlement negotiations. The scoping document solicited input from both the public and other interested parties who could provide additional expertise and perspective to the planning process. A public scoping meeting was held on May 10, 1999, in San Francisco. All comments received during the public scoping process were considered by the Trustees in the preparation of this document.

The second action to involve the public in Restoration Planning is to seek public comment and input on the suite of proposed projects described in this document. This draft RP/EA summarizes the available information concerning the nature and extent of the natural resource injuries, the Restoration Planning process, and the restoration projects being considered to restore injured resources or lost human-use services resulting from the Cape Mohican oil spill.

1.7 Administrative Record

The Trustee Council for this Restoration Planning process established an Administrative Record. The Administrative Record contains documents relied on by the Trustee in identifying, evaluating, selecting, and implementing restoration projects.

Comments received during the public review period for this draft RP/EA, the final RP/EA, and other restoration planning documents will become part of the Administrative Record. The Administrative Record can be viewed at the following locations:

- Building 201, Fort Mason, Golden Gate National Recreation Area - Park Headquarters
(Intersection of Franklin and Bay Streets)
- Websites: www.darcnw.noaa.gov/mohicn.htm and www.dfg.ca.gov/Ospr/index.html.

2.0 THE AFFECTED ENVIRONMENT

This section describes the physical environment, biological resources, federal and state endangered and/or threatened species, human-use resources, and protected areas affected, or within the area affected, by the Cape Mohican oil spill. The description of these resources focuses primarily on the natural resources and services that are relevant to the discussion of injuries and restoration projects presented in this document.

The physical environment addressed in this section includes the open water and shoreline habitats of San Francisco Bay, and intertidal and shoreline habitats of the Pacific Ocean (including the Farallon Islands) from Pacifica (San Mateo County) to Point Reyes (Marin County). The biological resource section describes a variety of seabirds, shorebirds, fish, mammals, and other organisms that live in the Bay and the California coast habitats. The federal and state recognized endangered California brown pelican (*Pelecanus occidentalis californicus*) is one example of a particularly sensitive species residing in the Bay and the California coast region.

The areas impacted by the spill include four units of the National Parks System: Golden Gate National Recreation Area (GGNRA, which includes Alcatraz Island, and Presidio of San Francisco), Fort Point National Historic Site (FPNHS), San Francisco Maritime National Historic Park, and Point Reyes National Seashore (PRNS). Additional areas impacted included three state parks: Angel Island, Candlestick Point, and Thornton State Beach; and two national marine sanctuaries (NMS): GFNMS and Monterey Bay NMS. The affected area (San Francisco Bay and surrounding ocean waters and coastline) includes four sub-units of the San Francisco Bay National Wildlife Refuge (NWR) Complex (Don Edwards San Francisco NWR, Marin Islands NWR, San Pablo Bay NWR, and Farallon NWR).

2.1 Physical Environment

The area impacted by the Cape Mohican oil spill is geologically and biologically diverse. The tidal cycles are mixed semi-diurnal. Currents and eddies are particularly variable depending on the specific location, and current velocities generally exceed three knots in the main channel of the Bay. Although winds are unpredictable, they predominately originate from the northwest. The mean year-round water temperature inside the Bay is 55° F.

Approximately ninety percent of the fresh water entering the Bay comes from the Sacramento and San Joaquin rivers, which provide drainage for nearly half of the state of California. The remaining 10 percent comes from smaller streams draining into the Bay from local watersheds. At the Golden Gate, seawater is approximately 33 parts sea salt per 1000 parts water (practical salinity units, psu) and decreases to 2 psu's in the delta of the north Bay (*Caffrey et. al. 1994*). Tidal action delivers salt water well up into the Sacramento-San Joaquin Delta and the salt water mixes with fresh water flows and returns to the Bay diluted (California Coastal Commission, 1987). This process creates some of the State's most unique and delicate habitats. These habitats are essential to the health of the diverse fish and wildlife populations of the Bay.

San Francisco Bay

San Francisco Bay is the largest estuarine/bay ecosystem on the Pacific coast of the United States and is considered one of the finest natural harbors in the world. The fish and wildlife habitats that characterize the Bay are invaluable resources that provide tremendous benefits to the people of the Bay Area and the State of California. The health of the Bay continues to receive pressure from industrial, residential, and commercial development of wetlands and adjacent uplands, and this trend threatens to irreversibly alter the ability of these habitats to support fish and wildlife resources.

The Central Bay consists of submerged lands, wetlands, uplands, and the main body of the San Francisco Bay. This sub-region expands along the west shore from Point San Pedro to Coyote Point, and the east shore from San Pablo to the San Leandro Marina and includes Alcatraz, Angel, Yerba Buena, and Treasure islands. Steep watersheds draining into broad alluvial fans characterize this sub-region. At their bayside boundaries, there are small tidal marshlands, sandy beaches, and lagoon habitats that are fed by small drainages, with areas of tidal flats and tidal marsh habitat. The habitats in the Central Bay sub-region have a stronger marine influence than the San Pablo and South sub-regions of the Bay. The Central Bay includes portions of San Francisco, Marin, Contra Costa, Alameda, and San Mateo counties.

Open Water. The open water of the Bay occupies a surface area of approximately 420 square miles, and the opening to the Pacific Ocean at the Golden Gate is approximately 1 mile wide (*USGS, 1973*). Open water areas include all areas below the line of mean lower low water (MLLW) that are not exposed during daily tides, including deep bays, shallow bays, deep major channels, and shallow major channels. Waters tend to be somewhat more turbulent in these areas because of the rip and long shore currents and shallow waters. Open water of the Bay provides habitat for numerous species of resident and migratory fish and wildlife.

Tidal Salt Marshes. Tidal salt marshes are found along the Bay edge between the mean tide level (MTL) and just above mean higher high water (MHHW). They are located in areas completely open to tidal influence and also include areas where culverts reduce the range of tides but still allow frequent inundation and exposure. The Emeryville Crescent, Berkeley and Albany shores are examples of tidal salt marshes within the spill area.

Much of the ecological value of the Bay is due to its wetlands, which are essential to the diverse and abundant fish and wildlife that occur in the area. The Bay's tidal salt marsh habitat supports a myriad of fish and wildlife, many of which are special status species, such as the federally endangered salt marsh harvest mouse (*Reithrodontomys raviventris*) and the federal and state endangered California clapper rail (*Rallus longirostris obsoletus*). Voles, shrews, and other small mammals also inhabit the salt marsh and are the main food for wetland raptors (e.g., northern harrier [*Circus cyaneus*], red-tailed hawk [*Buteo jamaicensis*]), and black-shouldered kite (*Elanus caeruleus*). Upland mammals (e.g. striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), and red fox (*Vulpes fulva*) forage at the upland transition, and occasionally into salt marsh, preying on resident rodents, birds, and invertebrates. Many species of fish and invertebrates utilize tidal salt marshes as nursery areas. Larval, juvenile, adult fish, inhabit tidal salt marshes at various stages of their life history. The Bay's tidal salt marshes also are used by harbor seals (*Phoca vitulina*) for haul-outs and breeding.

Tidal salt marshes in the Bay are dominated by two primary plant species: cordgrass (*Spartina spp.*) and pickleweed (*Salicornia virginica*). Cordgrass grows at the lower margins of the marsh, particularly along channels and in sheltered areas along the Bay margin. Common pickleweed occurs just above the zone of tidal inundation in saturated soils of relatively high salinity. Both of these species can occur as monotypic stands over many acres. Other plant species associated with pickleweed marsh include marsh jaumea (*Jaumea carnosa*), alkali heath (*Frankenia salina*), and marsh dodder (*Cuscuta salina major*). Saltgrass (*Distichlis spicata*), marsh gumplant (*Grindelia stricta angustifolia*), and coyote bush (*Baccharis pilularis*) often occupy a band at the upper elevation limit of the salt marsh.

Tidal Mudflats. Tidal mudflats are lands above MLLW but below the MTL and are exposed at low tides, constituting a true transitional area between open water habitats and marshes and channels leading into the Bay. Tidal mudflats like those in the Emeryville Crescent provide foraging areas for California halibut (*Paralichthys californicus*), sharks, sturgeons, and shorebirds. Invertebrates also inhabit tidal mudflats.

Tidal mudflats are intensely used as feeding grounds for shorebirds [e.g., godwits (*Limosa fedoa*) and willets (*Catoptrophorus semipalmatus*)] and nursery habitat for several species of fish including the Pacific herring (*Clupea pallasii*), which were affected by the spill. Staghorn sculpin (*Leptocottus armatus*), starry flounder (*Platichthys stellatus*), leopard shark (*Triakis semifasciata*), and California skate (*Raja inornata*) are other common fish found over mudflats. Harbor seals also forage over mudflat habitats for various fishes. An estimated 99 acres of mudflats were oiled by the spill.

Tidal Inlets and Lagoons. Lagoons are small areas of shallow water that are subject to occasional or sporadic connection to the Bay by full or mild tidal action. The inlet or lagoon may or may not receive stream or other forms of upland runoff, and it can be formed behind a barrier beach along an indented shoreline or artificial berm. Tidal inlets and lagoons provide habitat for shorebirds and wading birds.

Rocky Shores. Rocky shores within the Bay include boulder talus at the base of bedrock cliffs and cobble shores. Rocky shores can result from the combination of parent material, erosion, and drainage from adjacent land. Cobble Beaches, like those on Angel Island, are examples of rocky shores within the spill area. Rocky shores provide habitat for crab and snails, as well as foraging areas for shorebirds and wildlife. Approximately 516 acres of rocky intertidal habitat in the Bay and along the coast were oiled as a result of the spill.

Riprap, piers, pilings, and seawalls. Riprap, piers, pilings, and seawalls are man-made, and occur in many developed areas of the Bay. These constructed habitats may support a large diversity and abundance of marine life including fish and invertebrates. Mussels use the vertical substrates and Pacific herring use the pier pilings and shallow rocky substrate for spawning. Approximately 69 acres of this habitat type was oiled.

Salt Ponds. Salt ponds in the Bay are a constructed habitat. They are lands that have been diked and converted to produce salt. Prior to conversion, these areas were almost all former tidal wetlands, mudflats, and open water. The area surrounding the mouth of Alviso Slough is an example of a salt pond. Salt ponds provide valuable foraging areas for many species of shorebirds.

California Coast

The coastal areas affected by the oil spill included the Golden Gate south to Pillar Point (approximately 21 miles of coastline); the coastal area from the Golden Gate north to Drakes Beach in the PRNS (approximately 34 miles of coastline); and the Pacific Ocean immediately offshore from these areas.

The physical environment of the area consists of open water, submerged lands of the Pacific Ocean, and coastal shoreline habitats. The California shoreline affected by the oil spill is a high-energy environment that experiences nearly constant wind, intense wave action, salt spray, and constant erosional processes. These forces limit the distribution of plants and animals to only those relatively few capable of withstanding the harsh conditions and unstable substrates.

North and south of the Golden Gate, the immediate shoreline is interspersed with rocky hills that terminate in vertical cliffs and coastal bluffs; rocky headlands; coastal strands; sandy beaches; sandy dunes; tidal inlets; rocky intertidal zones; and in-water artificial habitats including rock shoreline protection (concrete and boulder riprap), piers, wood, concrete pilings, and seawalls. The following describes habitats that characterize the affected physical environment of the California coast.

Coastal Bluffs. Coastal bluffs are the seaward edges of marine terraces uplifted from the ocean floor and shaped by ocean waves and currents. Coastal bluffs are generally subject to ongoing erosion and occasional mass movement (e.g., Devil's Slide on Highway 1 and Palomarin). Vegetation on the cliffs and bluffs tends to be low growing and tolerant of constant wind and salt spray. Iceplant (*Carpobrotus*

spp.), coyote brush, wildflowers (e.g. poppies, irises, and lupines), introduced annual grasses, and native fescues have adapted to grow on steep bluffs.

Sandy Beaches. Beaches are dynamic landforms altered by wind and waves in a continual process of accretion and erosion. Seasonal cycles of sand deposition and loss severely affect the appearance of beaches from summer to winter. In the summer they are wide and gently sloping, and in the winter they become steep and narrow. Violent storm waves can erode a beach overnight. Sand removed from winter beaches is deposited in offshore sandbars and is returned to the beach during the summer months by gentle swells that push the sand to the exposed shore. River sediments are the source of 80 to 90 percent of beach sand. Stinson Beach is one example of a sandy beach formed by a bar across the mouth of Bolinas Lagoon. Sandy beaches provide foraging and nesting habitat for shore and wading bird species. An estimated 56 miles, or 1,124 acres, of sandy beach habitat were oiled by the spill.

A coastal strand is a form of a sand beach and is located between the base of cliffs or bluffs and the active surf zone. Coastal strands tend to be narrow and may advance or retreat in any given year, depending on the frequency and intensity of winter storms. They tend to erode back toward the bluffs with the winter storm season and slowly rebuild over the summer and fall months. Longshore flows carry sands from river and creek mouths along the coast to build or rebuild coastal strands. Coastal strands often appear sterile, supporting little in the way of plant life. However, different types of invertebrates live in these sand beaches and surf zones, and provide a food source for shorebirds and fish. Thornton State Beach is an example of a coastal strand.

Sand Dunes. Sand dune complexes will form when the correct combinations of sand and wind patterns occur. Offshore sandbars and sediment from rivers are the most important sources of sand for dune building. Longshore currents carry sediments until they are trapped and deposited on the beach by wave action. Wind will then blow sand into dunes. Sand dune contours shift over time until hardy dune plants take hold in the drifting sand and create a stable landform. However, dunes can change form quickly under the stress of storm waves and wind, or the traffic of human activity. Baker Beach, within the GGNRA, is an example of a small dune complex. Sand dunes provide habitat for a variety of shorebirds, mammals, and reptiles.

Rocky Shores. Rocky shores along the coast include headlands, intertidal and uplifted benches, boulder talus at the base of bedrock cliffs, and cobble shores. Rocky shores often occur in areas where there is sufficient water movement to facilitate erosion and prevent sand deposition. Headlands, such as the Point Reyes Headlands in Marin County occur, anywhere that erosion-resistant igneous rocks (e.g., granite and basalt) are found along the shore. The rocky intertidal zone is located on the shoreline between the high and low tide levels and is frequently covered and uncovered by the advance and retreat of the tides (e.g., Duxbury Reef and Fitzgerald Marine Reserve). “Seastacks” are remnant, resistant rock outcrops, that occur offshore at several locations throughout the area. Rocky shores are important areas for algae, echinoderm, arthropod, and mollusk species as well as the shorebirds and wildlife that prey upon them. Approximately 516 acres of rocky intertidal habitat in the Bay and along the coast were oiled from the spill.

Tidal Inlets and lagoons. Tidal inlets along the shores are the primary conduits for sediments and nutrients between the ocean and estuary. They also are very significant for adjacent shorelines because they trap and retain huge reservoirs of sand and periodically release sediment to the beach. Examples in the spill area include Rodeo Lagoon and Redwood Creek. These coastal features are extremely important areas for wildlife such as migratory shorebirds and waterfowl, salmonids, and nursery areas for fish and invertebrates.

Farallon Islands. The Farallon Islands are a group of four island/rock groups located 26 nautical miles directly west of the Golden Gate. These small islands range in size from approximately 2 acres (Noonday

Rock, when exposed) to 120 acres (Southeast Farallon including Maintop Island and associated rocks). Other Islands in the group are North Farallon rocks (61 acres) and Middle Farallon rocks (28 acres, when completely exposed). The Farallon Islands were not directly affected by the Cape Mohican oil spill. However, birds that inhabit these islands were affected by the spill and restoration is proposed to occur on one of the islands.

2.2 Biological Resources

San Francisco Bay

The Bay contains approximately 1,600 square miles of wetlands and open water and is the largest estuary on the Pacific coast of the United States. The Bay and California coastal areas impacted by the Cape Mohican oil spill lie within the Golden Gate Biosphere Reserve (GGBR). This designation has been given to 300 reserves worldwide by the United Nations to recognize certain areas as models of how to protect their extraordinary resources of wildlands and sensitive areas while ensuring their non-destructive human-use and enjoyment. The international recognition designation confirms its importance to the conservation of biodiversity, sustainable development, research, and education. The GGBR is unique because it includes marine, coastal, and upland resources adjacent to a large metropolitan area, thus providing easy access to outdoor education and recreation for the people of the Bay Area and its visitors. This section describes the biological resources that use the Bay and California coast physical environments discussed above.

Birds. All of the shoreline habitats of the Bay and California coast provide essential habitat for seabirds, waterfowl, wading birds, and shorebirds. The habitats are used by a variety of waterbirds and shorebirds for nesting, resting, and foraging during migration stopovers and the winter months. Many species are year-round residents.

The Bay and the California coast are critical areas for birds using the Pacific Flyway. The Bay's 1,600 square miles of wetlands and open water are home to approximately 800,000 waterbirds at any given time and to millions during peak migration (USFWS, 1987). Some of these birds are permanent residents and a few come to the Bay only to breed. Most, however, use the Bay as a resting and feeding stop on their long migrations. Approximately 70 percent of the birds that migrate along the Pacific Flyway use the Bay for some period each year (Blake and Steinhart, 1987). Scientists have identified at least 281 species of birds that use the Bay, not including species that inhabit adjacent upland areas (USFWS, 1987).

Habitats of the Bay support a large variety of resident and migratory waterbird species including waterfowl, gulls, terns, murrelets, cormorants, loons, egrets, and herons. Numerous species of waterfowl use the Bay such as canvasback (*Aythya ferina*), pintail (*Anas acuta*), bufflehead (*Bucephala albeola*), goldeneye (*Bucephala clangula*), and gadwall (*Anas strepera*). In fact, close to one-half of the migratory populations of the west coast waterfowl winter in the Bay. As a result, the Bay is identified by the North American Waterfowl Management Plan as one of 34 waterfowl habitats of major concern (San Francisco Bay Joint Venture, 2001).

The Bay and California coast also provide essential nesting, resting, and foraging habitat for several state and federally protected bird species. These include species such as the California brown pelican, California least tern (*Sterna antillarum browni*), western snowy plover (*Charadrius alexandrinus nivosus*), California clapper rail, and California black rail (*Laterallus jamaicensis coturniculus*).

The Bay supports more shorebirds than all other estuaries in California combined, and nearly one million shorebirds have been counted in a single day during migration. The Bay is designated as a site of "Hemispheric Importance" because of the large populations of shorebirds that depend on the Bay

(*San Francisco Bay Joint Venture, 2001*). A study by Page et al. (1999) of shorebird abundance and distribution showed that the Bay was a critically important wetland because of the high number of shorebirds present throughout the year. For the 13 shorebird species surveyed in this eight-year west coast study, between 24 and 96 percent of the populations of these species occurred in the Bay in all seasons of the year.

Marine mammals. Several species of marine mammals utilize the Bay. The most abundant species is the harbor seal, which uses deep and shallow habitats for foraging and is a resident of the Bay. Hundreds of animals use Castro Rocks and other rocky out-croppings, as well as mudflats and marsh areas in the South Bay to haul out and breed. Other marine mammals can occasionally be found in the Bay including: northern elephant seals (*Mirounga angustirostris*); California sea lions (*Zalophus californianus*); humpback whales (*Megaptera novaeangliae*); California Gray whales (*Eschrichtius robustus*); harbor porpoise (*Phocoena phocoena*).

Fish. The Bay provides resident and migratory habitat for numerous species of important and sensitive fish species. The Bay is used as a migratory corridor by anadromous fish species including protected steelhead (*Oncorhynchus mykiss irideus*); Coho salmon (*Oncorhynchus kisutch*); Winter-run chinook salmon (*Oncorhynchus tshawytscha*); spring-run chinook salmon (*Oncorhynchus tshawytscha*). Other special status species that reside in the Bay include the Delta smelt (*Hypomesus transpacificus*), and Sacramento splittail (*Ogonichthys macrolepidotus*).

Pacific herring and California halibut (*Paralichthys californicus*) use the Bay as a nursery, and rockfish (*Sebastes* spp), sculpin, American shad (*Alosa sapidissima*) also live in the Bay. Sturgeon (*Acipenser transmontanus* and *A. medirostris*) and Striped bass (*Morone saxatilis*) typically live in the Bay and migrate upstream into rivers and the Delta to reproduce.

Seaweeds and Seagrasses. A variety of seaweeds and seagrasses occur in several different habitats within the Central Bay. Rocky intertidal areas, such as the Tiburon Peninsula and Alcatraz provide substrate for many seaweeds like rockweed (*Fucus distichus*) and Sea lettuce (*Ulva* spp), and surfgrass (*Phyllospadix torreyi*). In deeper subtidal rocky areas, many other species of seaweeds such as kelp, fleshy reds, articulated coralines, and green seaweeds occur. Seaweeds and surfgrass provide structural habitat for many species of fish and invertebrates, as well as a food source and spawning substrate.

In soft bottom, shallow areas of the central Bay, eelgrass (*Zostera marina*) and a few seaweeds (*Gracilaria* sp., *Ulva* sp.) occur. Eelgrass serves as a very important habitat for spawning fishes (herring, surf perch [*Amphistichus* spp.]); living habitat for a variety of shrimp and Bay fish; forage for fish and waterfowl; and as a nursery area for many species of crab, shrimp, and fish (e.g. California halibut, surf perch).

California Coast

Birds. Many bird species use the open ocean of the California coast including common murre (*Uria aalge*), several gull and tern species, pelagic cormorants (*Phalacrocorax pelagicus*), Brandt's cormorant (*Phalacrocorax penicillatus*) (state species of concern), several species of auklets (*Aethia* spp.), and federally threatened and state endangered marbled murrelet (*Brachyramphus marmoratus*). The California brown pelican, numerous species of waterfowl, and wading birds such as egrets and herons use the near-shore waters lagoons and tidal inlets along the coast. The California least tern, western snowy plover, and many other shorebird species use the sand dunes for shelter and breeding areas. Many shorebird species also can be found foraging along sandy beaches and rocky shores.

Marine mammals. An abundance of marine mammal species forage, breed, or migrate along the California coast. Six species of pinnipeds inhabit in the area including: Steller sea lions (*Eumetopias*

jubatus), California sea lions, northern elephant seals, harbor seals, northern fur seals (*Callorhinus ursinus*), and Guadalupe fur seals (*Arctocephalus townsendi*). Whales, including California gray, humpback, blue (*Balaenoptera musculus*), fin (*Balaenoptera physalus*), dolphins and porpoise migrate and forage along the coast. Sea otters (*Enhydra lutrus*) are observed in the Gulf of the Farallones a few times a year.

Fish. Numerous resident and migratory fish species use the nearshore area, tidal inlets, and lagoons for nursing, feeding, and spawning areas. Several species of surfperch, over three dozen species of rockfish (*Sebastes spp.*, *Sebastolobus spp.*), lingcod (*Ophiodon elongatus*), cabezon (*Scorpaeni marmoratus*), kelp greenling (*Hexagrammos decagrammus*), and several species of sharks, rays, and eels are included. California halibut forage in sandy bottom areas just outside the active surf zone and enter the Bay to spawn over shallow mudflats. Northern anchovy (*Engraulis mordax*), an important forage fish in California waters, spawn in the open ocean. Upon hatching and spending time in open water as planktonic larvae, the juveniles move into the Bay to use the shallow areas for protection and feeding. Tidal inlets provide habitat for sensitive aquatic species such as salmon, steelhead trout, striped bass, and the federally endangered tidewater goby (*Eucyclogobius newberri*). The tidewater goby, a special status species, is known to inhabit in Rodeo Lagoon.

Invertebrates

Hundreds of species of invertebrates occur along this spill-affected coast in sandy and rocky habitats from the high intertidal zone to the surf zone to the subtidal benthos. In sandy habitats, a variety of clams and crustaceans can be found, including the Dungeness Crab (*Cancer magister*) an important commercially harvested species. On sandy beaches, a variety of crabs, amphipods, flies, and beetles live in the surf zone and on kelp wrack that drifts ashore. These organisms provide an important food source for shorebirds. On sandy reefs and rocky intertidal areas, a wide variety of invertebrates exist, including red abalone (*Halvotis rufescens*) an important recreational species, other snails, limpets, mussels, barnacles, worms, sponges, and other types of crustaceans. All of these species exist to form a complex ecosystem along the California coast.

Vegetation. The California coast harbors an impressive assemblage of seaweeds, from the high intertidal zone to subtidal zones of 100 feet deep. Those species found in the Bay can also be found along the coast and hundreds of other species. Canopy forming kelp forests are found along the coast in lower intertidal and subtidal nearshore zones. Some species include: seagrass (*Phyllospadix spp.*) and seaweeds such as rockweed that cling to rock faces just at and below the high tide line. In addition, canopy forming kelp occurs in the lower and upper intertidal zone of the California coast, including: giant kelp (*Macrocystis pyrifera*), bull kelp (*Nereocystis luetkeana*), intertidal giant kelp (*Macrocystis integrifolia*) and feather boa kelp (*Egregia menziesii*). Kelp forests provide essential habitat for many species of fish, invertebrates, seabirds and marine mammals. They are a source of nutrients for subtidal and beach ecosystems. They buffer coastal areas from ocean waves and swells, reducing erosion of shoreline areas.

On the high beach and into the sand dunes, a variety of vascular terrestrial plants grow. Providing habitat for birds, mammals, and reptiles, sand dune vegetation also stabilizes blowing sands. Native dune plants along the coast include sand verbena (*Abronia latifolia*), dune wild rye (*Elymus mollis*), and sandbur (*Ambrosia chamissonis*). Sand dunes support many rare and listed species as well, such as: Sonoma spine flower (*Chorizanthe valida*), presidio clarkia (*clarkia franciscana*), Santa Cruz tarplant (*Holocarpha macradenia*), beach layia (*Layia carnosa*), and California seablite (*Suaeda californica*). In recent times much of the native dune plant species have been reduced, or completely displaced, by introduced iceplant and European beach grass (*Ammophila arenaria*). These invasive species create dense monotypic stands, reducing ecological diversity.

Farallon Islands. The Farallon Islands and the waters surrounding them are part of a highly productive ecosystem. They are located at the edge of the continental shelf where nutrient-rich bottom waters upwell into the shallow photic zone where plants and animals flourish. Zooplankton such as krill appears in abundance in most years, attracting seabirds such as Cassin's auklet (*Ptychorocamphus aleuticus*) and tufted puffin (*Fratercula cirrhata*). Additionally, the abundance of food draws many whales to the area. Seabirds and mammals have historically taken advantage of the islands isolation and lack of predatory pressure to nest and breed. The Farallon Islands support 12 nesting seabird species (e.g., common murre, cassins auklet, and western gull [*Larus occidentalis*]) and six breeding species of pinnipeds (e.g. harbor seal, Steller sea lion, and northern fur seal). Over 430 species of land birds, shorebirds, and seabirds have been recorded on the islands, mostly as stopovers during migration.

2.3 Endangered and Threatened Species

The United States Endangered Species Act (ESA) of 1973 and the State of California ESA of 1970 direct federal and state agencies to protect and conserve listed endangered and threatened fish, plants, and wildlife. The habitat of endangered, threatened, and rare species takes on special importance because of these laws, and the protection and conservation of these species requires diligent management of their habitat. Species that appear on the endangered and threatened lists were historically more widespread in their distribution, but are currently restricted to diminishing habitat.

As illustrated in Table 2, the shoreline, open water, marsh, and estuarine habitats of the Bay and California coast support numerous endangered and threatened fish and wildlife species. Two special status species were adversely affected by the oil spill; the California brown pelican and western snowy plover. Oiled pelicans were observed at many locations in the Bay and along the outer California coast during the spill. Five dead pelicans were found during the spill, and 15 live oiled pelicans were captured, cleaned at the rehabilitation center, tagged with radio transmitters, and released back into the Bay. The California brown pelican is listed as "Endangered" on both federal and state listings (Listed: *CDFG, 1978; USFWS, 1979*) and occurs along the Pacific coast from Canada to Mexico. Pelicans are seasonal migrants to the Bay and California coast during late summer, fall, and winter months and feed throughout the Bay and nearshore coastal waters.

Nine western snowy plover were observed oiled on Ocean Beach. The western snowy plover is listed as "Threatened" under the federal ESA (Listed: *USFWS, 1993*). The western snowy plover spends as much as 10 months on the California coast. They require unpolluted feeding areas on sand beaches and in lagoons and estuaries all year. They prefer undisturbed nest sites on open, sandy, or gravelly shores near shallow water feeding areas in estuaries. San Francisco Bay is considered important for these species. The restoration of habitat for special status species that use the Bay and coast will enhance populations of these species.

Table 2. Animal and Plant Species Presently Listed Under The Federal and/or State Endangered Species Acts Occurring Within The Affected Area of The Spill (USFWS, 2001; CDFG, 2001)

Species (E = Endangered, T = Threatened, F = Federal, S = State)

Common Name	Scientific Name
Birds	
California black rail	(ST) <i>Laterallus jamaicensis coturniculus</i>
California brown pelican ¹	(FE, SE) <i>Pelecanus occidentalis californicus</i>
Bald eagle	(FT) <i>Haliaeetus leucocephalus</i>
California clapper rail ²	(FE) <i>Rallus longirostris obsoletus</i>
Western snowy plover ¹	(FT) <i>Charadrius alexandrinus nivosus</i>
California least tern	(FE) <i>Sterna antillarum browni</i>
Marbled murrelet ²	(FT, SE) <i>Brachyramphus marmoratus</i>
Fish	
Winter-run chinook salmon ²	(FE, SE) <i>Oncorhynchus tshawytscha</i>
Central Valley spring-run chinook salmon	(FT, ST) <i>Oncorhynchus tshawytscha</i>
Coho salmon Central California ESU	(FT) <i>Oncorhynchus kisutch</i>
Steelhead ² Central California Coastal ESU	(FT) <i>Oncorhynchus mykiss irideus</i>
Delta smelt	(FT, ST) <i>Hypomesus transpacificus</i>
Tidewater goby ²	(FE) <i>Eucyclogobius newberryi</i>
Sacramento splittail	(FT) <i>Pogonichthys macrolepidotus</i>

Table 2. Animal and Plant Species Presently Listed Under The Federal and/or State Endangered Species Acts Occurring Within The Affected Area of The Spill (USFWS, 2001; CDFG, 2001)

Species (E = Endangered, T = Threatened, F = Federal, S = State)

Common Name	Scientific Name
Mammals	
Salt marsh harvest mouse ²	(FE) <i>Reithrodontomys raviventris</i>
Guadalupe fur seal	(FT, ST) <i>Arctocephalus townsendi</i>
Steller (=northern) sea-lion ²	(FT) <i>Eumetopias jubatus</i>
Southern sea otter ²	(FT) <i>Enhydra lutris nereis</i>
Sei whale ²	(FE) <i>Balaenoptera borealis</i>
Blue whale ²	(FE) <i>Balaenoptera musculus</i>
Finback (=fin) whale ²	(FE) <i>Balaenoptera physalus</i>
Right whale	(FE) <i>Eubalaena glacialis</i>
Sperm whale	(FE) <i>Physeter catodon</i> (= <i>macrocephalus</i>)
Humpback whale ²	(FE) <i>Megaptera novaeangliae</i>
Reptiles	
Green sea turtle	(FT) <i>Chelonia mydas</i> (incl. Agassizi)
Loggerhead turtle	(FT) <i>Caretta caretta</i>
Olive (=Pacific) Ridley sea turtle	(FT) <i>Lepidochelys olivacea</i>
Leatherback turtle ²	(FE) <i>Dermochelys coriacea</i>
Alameda whipsnake	(FT, ST) <i>Masticophis lateralis euryxanthus</i>
San Francisco garter snake	(FE) <i>Thamnophis sirtalis tetrataenia</i>

Table 2. Animal and Plant Species Presently Listed Under The Federal and/or State Endangered Species Acts Occurring Within The Affected Area of The Spill (USFWS, 2001; CDFG, 2001)

Species (E = Endangered, T = Threatened, F = Federal, S = State)

Common Name	Scientific Name
Amphibians	
California red-legged frog ²	(FT) <i>Rana aurora draytonii</i>
Invertebrates	
California freshwater shrimp	(FE, SE) <i>Syncaris pacifica</i>
Mission blue butterfly	(FE) <i>Icaricia icarioides missionensis</i>
San Bruno elfin butterfly	(FE) <i>Incisalia(=Callophrys) mossii bayensis</i>
Bay checkerspot butterfly	(FT) <i>Euphydryas editha bayensis</i>
Callippe silverspot butterfly	(FE) <i>Speyeria callippe callippe</i>
Myrtle's silverspot butterfly	(FE) <i>Speyeria zerene myrtleae</i>
Plants	
Sonoma alopecurus ²	(FE) <i>Alopecurus aequalis</i> var. <i>sonomensis</i>
Presidio manzanita	(FE, SE) <i>Arctostaphylos hookeri</i> ssp. <i>ravenii</i>
San Bruno Mountain manzanita	(SE) <i>Arctostaphylos imbricata</i>
Pacific manzanita	(SE) <i>Arctostaphylos pacifica</i>
Marsh sandwort	(FE, SE) <i>Arenaria paludicola</i>
Tiburon mariposa lily	(FT, ST) <i>Calochortus tiburonensis</i>
Tiburon Indian paintbrush	(FE, ST) <i>Castilleja affinis</i> ssp. <i>neglecta</i>
Robust spineflower	(FE) <i>Chorizanthe robusta</i>
Sonoma spineflower	(FE) <i>Chorizanthe valida</i>
Presidio clarkia	(FE, SE) <i>Clarkia franciscana</i>
Marin dwarf-flax	(FT, ST) <i>Hesperolinon congestum</i>
Santa Cruz tarplant	(FT, SE) <i>Holocarpha macradenia</i>
Beach layia ²	(FE, SE) <i>Layia carnosa</i>

Table 2. Animal and Plant Species Presently Listed Under The Federal and/or State Endangered Species Acts Occurring Within The Affected Area of The Spill (USFWS, 2001; CDFG, 2001)

Species (E = Endangered, T = Threatened, F = Federal, S = State)

Common Name	Scientific Name
Plants	
San Francisco lessingia	(FE, SE) <i>Lessingia germanorum</i>
White-rayed pentachaeta	(FE, SE) <i>Pentachaeta bellidiflora</i>
San Francisco popcorn-flower	(SE) <i>Plagibothrys diffusus</i>
Hickman's potentilla (=cinquefoil)	(FE, SE) <i>Potentilla hickmanii</i>
Tiburon jewel-flower	(FE, SE) <i>Streptanthus niger</i>
California seablite	(FE) <i>Suaeda californica</i>
Showy Indian clover	(FE) <i>Trifolium amoenum</i>

1 Species directly affected by Cape Mohican oil spill.

2 Species likely affected by Cape Mohican oil spill.

2.4 Protected Areas

There are numerous federal and state parks, refuges, marine sanctuaries, and several municipal shorelines, beaches, and waterfronts in and around the Bay and the California coast. Several of these protected areas were directly impacted by the oil spill or were within the area affected. These protected areas were established to protect and conserve natural resources, scenery, historic objects, cultural resources, threatened and endangered plants and animals, and environmentally sensitive habitats. The protected areas also provide a valuable resource for public use, and comprise a substantial year-round element of the Bay Area economy. Common recreation activities on many of these areas includes beach-going, picnicking, wildlife viewing, environmental interpretation, sport fishing, boating, surfing, boardsailing, sightseeing, and similar activities. The effects of the oil spill on these areas included oiled shorelines, adverse impacts to natural resources that use these areas, and lost public use.

This section identifies and provides a brief description of the protected areas that occur within the area affected by the oil spill or where restoration projects are proposed to be implemented. A brief description of the environmental values and human-use activities of each area is presented.

2.4.1 Federally Protected Areas

National Parks

The National Park Service (NPS) was established to conserve the scenery, natural and historic objects and wildlife within its parks and to protect and preserve these natural and cultural resources for the public. The following describes each national park affected by the spill.

Golden Gate National Recreation Area (GGNRA)

The Golden Gate National Recreation Area designation was October 27, 1972. Located where the Pacific Ocean meets San Francisco Bay, GGNRA is the largest urban national park in the world and includes 74,000 acres of land and water and approximately 28 miles of coastline. Spanning the entrance to the San Francisco Bay, and three counties (San Francisco, Marin and San Mateo), the GGNRA includes Alcatraz Island and the Presidio of San Francisco. The GGNRA also manages FPNHS and Muir Woods National Monument. The park offers a combination of natural beauty, historic features, and public recreation facilities. Reaching north and south of the Golden Gate along the Pacific shoreline, GGNRA includes a significant coastal preserve and numerous public recreation areas including redwood forests, grassy hillsides, beaches, marshes, and rocky shorelines. The park provides habitat for a variety of wildlife including seabirds, hawks, deer, occasional bobcats (*Felis rufus*), seals, and whales.

Activities at GGNRA range from urban recreation to semi-wilderness hiking and camping in the Marin Headlands. Alcatraz Island, Fort Point National Historic Site, and the Presidio of San Francisco were affected by the spill. Portions of GGNRA were closed to visitors during oil spill cleanup operations including Aquatic Park/Municipal Pier, Baker Beach, China Beach, Crissy Field, Fort Point Pier, Land's End Beaches, Ocean Beach, East Fort Baker/Horseshoe Cove, East Fort Baker Fishing Pier, Kirby Cove to Point Bonita, and Rodeo Beach. Further, the quality of park visits was diminished as a consequence of the spill due to oiled beaches and spill response cleanup activities.

Alcatraz Island National Historic Landmark

One of the GGNRA's most popular destinations, Alcatraz Island is located in the middle of the Bay and is the site of the historic Alcatraz federal prison. Visitors to the island can explore the remnants of the prison, learn about the Native American occupation of 1969 through 1971 and early military fortifications, and visit the West Coast's first and oldest operating lighthouse. The island is approximately 1 mile in circumference and rises 130 feet above the Bay.

The island also features gardens, tide pools, bird colonies, and Bay views. It is also the only location in the Bay where Brandt's cormorants nest. Because of its isolated location, Alcatraz Island has developed a unique flora and fauna. Plant communities on the island have adapted to numerous niche environments as have animal inhabitants such as the deer mouse (*Peromyscus maniculatus*), which has developed a lighter coloring that blends in with the concrete of the prison buildings.

Presidio of San Francisco

The Presidio of San Francisco was designated a National Historic Landmark District in 1962 and is located along the south shore of the entrance to San Francisco Bay. On October 1, 1994, the Presidio became part of the GGNRA. For thousands of years, the Ohlone Tribe managed and harvested the natural bounty of the Presidio area. In 1776, arrival of Spanish soldiers and missionaries marked the beginning of 218 years of military presence in the area. The Presidio served as a military post under the flags of Spain (1776 through 1822), Mexico (1822 through 1848), and the United States (1848 through 1994).

The Presidio's 1,480 acres afford visitors a variety of historic and natural attractions including more than 500 historic buildings, a collection of coastal defense fortifications, a national cemetery, an historic airfield, a saltwater marsh, forests, beaches, native plant habitats, coastal bluffs, miles of hiking and biking, and spectacular ocean and Bay views.

Fort Point National Historic Site (FPNHS)

The FPNHS, managed by GGNRA, was designated as a National Historic Site in 1970 and consists of 29 acres bordering the mouth of San Francisco Bay at the south side of the Golden Gate. Fort Point was constructed by the U.S. Army Corps of Engineers between 1853 and 1861 to prevent entrance of a hostile fleet into San Francisco Bay. The Fort was occupied throughout the Civil War. Today the site receives over 1.5 million visitors a year. Fort Point is particularly noteworthy for several rare and endemic plant

species. Native plant communities still cling to the precipitous slopes above the Fort. Freshwater seeps at Fort Point support the rare San Francisco fork-tailed damselfly (*Ischnura gemina*). The site also includes the waters of the Bay within ¼ mile of shore, which serves as an important wintering site for thousands of loons, grebes and cormorants. Recreational fishing and crabbing are popular resource dependent activities at Fort Point.

Point Reyes National Seashore (PRNS)

The PRNS was established on September 13, 1962, and is located north of the Golden Gate on the coast of Marin County. The PRNS consists of 72,000 acres of land and 20,000 acres of water, and the boundary extends approximately 10 nautical miles offshore. The PRNS encompasses 80 miles of shoreline and several estuaries, including Tomales Bay. PRNS also contains open grasslands, hillsides, coastlines, and forested ridges with unique elements of biological and historical interest.

Because of its location at the midpoint of the California coast and the many distinct habitats that exist within its borders, PRNS supports a wide range of species including 37 native land mammal species and more than 23 marine mammal species recorded. PRNS has breeding colonies of harbor seals, the largest concentration in California, elephant seals, and large nesting colonies of 12 seabird species. Over 45 percent of the bird species in North America have been sighted at PRNS and 20 percent of the state's flowering plant species are represented on the peninsula. PRNS is also a popular recreation area with approximately 2.6 million visitors each year. Recreation includes activities such as surfing, swimming, beach combing, fishing, and boating.

National Wildlife Refuges (NWR)

Several NWR units administered by the USFWS occur in San Francisco Bay and nearby areas of the Pacific Ocean. The NWRs were created to preserve the diversity of natural flora and fauna in the Bay Area region, with particular attention given to protection of vulnerable migratory bird resources. The following describes each NWR in the area affected by the oil spill.

The San Francisco Bay NWR Complex

The San Francisco Bay National Wildlife Refuge Complex includes four sub-units that occur in the affected area: Don Edwards San Francisco NWR, Marin Islands NWR, Farallon NWR, and San Pablo Bay NWR.

Don Edwards San Francisco NWR

The Don Edwards San Francisco NWR includes 25,000 acres in south San Francisco Bay. The refuge provides habitat for many species of migratory birds, as well as the endangered California clapper rail, California least tern, California brown pelican, and salt marsh harvest mouse. Visitors to the refuge can learn about the Bay environment, attend naturalist programs, observe wildlife, hike, fish, and hunt.

Marin Islands NWR

Marin Island NWR consists of the West Marin and East Marin islands. The refuge objectives are to protect nesting waterbirds and other wildlife from disturbance; enhance native habitat for nesting and roosting birds; and to protect tidal mudflats and the islands' ecosystems.

Farallon NWR

Located 26 nautical miles west of the Golden Gate, the Farallon NWR encompasses the largest seabird breeding colony on the Pacific Coast south of Alaska, supporting over 300,000 birds in the summer. Although the refuge islands are closed to public access, wildlife can be observed, studied, and photographed at a distance from boats. The Farallon Islands are part of the Farallon Ridge and include 211 acres of rocky islands. Where shallow soils occur on parts of the south Farallones, vegetation is

dominated by Farallon weed, which is used by cormorants and gulls for nest building material. Although refuge lands were not oiled by the spill, birds that utilize the Farallon NWR were oiled.

Proposed Alameda NWR

The proposed Alameda NWR includes the site of a nesting colony of 200 pairs of California least terns that is among the top three colonies for chick production in California. The DOI has requested 900 acres (525 acres of land and 375 acres of open water) from the 2,796-acre Naval Air Station Alameda, which was closed on April 25, 1997. The breakwater within the proposed Alameda NWR is a summer and fall roost site for more than 2,400 endangered California brown pelicans and is considered the most important roost, and the only known night roost, in the Bay. The breakwater is also the site of one of the largest western gull colonies in central and northern California. The breakwater is also used by harbor seals, including pups, as a haul-out area. Wetland areas within the proposed refuge boundaries support one of the largest Caspian tern nesting colony (1,000 nests) on the Pacific coast, and nesting ducks, geese, shorebirds, and other waterbirds.

National Marine Sanctuaries (NMS)

In 1972, Congress established the National Marine Sanctuary Program. Today, marine sanctuaries encompass whale migration corridors, nearshore coral reefs, deep-sea canyons, and underwater archeological sites. Two NMS were directly impacted by the oil spill and include the GFNMS and the Monterey Bay NMS.

Gulf of the Farallones NMS (GFNMS)

The majority of the Gulf of the Farallones was designated in 1981 as the Gulf of the Farallones National Marine Sanctuary. The GFNMS is located west of the Golden Gate out to 50 nautical miles offshore and includes 1,255 square miles of Pacific Ocean along with nearshore tidal flats, rock intertidal areas, wetlands, subtidal reefs, and coastal beaches. The Farallon Islands, located 26 nautical miles west of the Golden Gate in the south central part of the sanctuary, is a federal wildlife refuge offering resting and breeding sites for marine mammals and seabirds. The sanctuary provides refuge for 36 marine mammal species, thousands of seals and sea lions, and is home to the largest concentration of breeding seabirds in the continental United States.

Monterey Bay NMS

In 1992, the waters of Monterey Bay and the adjacent Pacific Ocean off the central California coast were designated and protected as the Monterey Bay NMS. The sanctuary runs 400 nautical miles north to south, extends 35 nautical miles offshore, and covers over 5,300 square miles. The goal of the sanctuary is to protect natural resources, water quality, habitats, cultural resources, and resident and migratory marine life.

2.4.2 State Protected Areas

Many state-owned lands occur within the spill area. They are managed by several different state agencies including the CDFG, CDPR, and State Lands Commission. The CDFG manages the Corte Madera Marsh Wildlife Area and the Albany Marsh Wildlife Area. The CDFG also includes the Marin Islands as a State Refuge, however, it is managed by the USFWS. The CDPR manages Angel Island, Candlestick Point, and Thornton Beach State parks. Other protected areas exist, but are owned and managed by regional or local municipalities. One of the largest is the East Bay Regional Parks District whose lands include Brooks Island, Miller/Knox Park, Pt. Isabel, and Crown Beach. All of these parks were within the spill area.

California State Parks

The mission of the California Department of Parks and Recreation is to provide for the health, inspiration, and education of the people of California by helping to preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high-quality outdoor recreation.

The State Park system includes approximately one-third of California's scenic coastline and many of the state's finest coastal wetlands, estuaries, beaches, and dune systems. The following describes each California State Park that was impacted by the oil spill.

Angel Island State Park

Established as a State Park in 1961, Angel Island is located north of San Francisco in the central sub-region of the Bay. Consisting of 740 acres, it is the largest island in the Bay and offers spectacular views of the San Francisco skyline, Marin Headlands, and Mount Tamalpais. It is accessible only by private boat or public ferry.

The historic island has served as a Civil War fort, a stone quarry, a major military embarkation point, and a Chinese immigration station. The island has a long history of human-use beginning 3,000 years ago when the island was used by Miwok Indians as a hunting and fishing site. In more recent times, it was a refuge for Spanish explorer Juan de Ayala, a U.S. Army post, and, from 1910 to 1940, an immigration station. During World War II, it served as a holding site for Japanese and German prisoners of war and a debarkation point for American soldiers returning from the Pacific. In the 1950s and 1960s, the island was home to a Nike missile base. Today, there are two active U.S. Coast Guard stations on the island: Point Blunt and Point Stuart.

Visitors can bird watch, enjoy nature, camp, sunbathe, beachcomb, participate in environmental educational activities, hike foot trails and fire roads that circle the island, and climb to the 781-foot high summit of Mount Caroline Livermore as well as visit the immigration station, which has a museum in the barracks building. Angel Island was closed during cleanup operations from the oil spill, resulting in lost visitor use. Areas closed included: China Cove, Quarry Beach, Perle's Beach, Ayala Cove Beach, West Garrison Beach, and East Garrison Beach.

Candlestick Point

Candlestick Point is located next to 3Com Park in San Francisco. Candlestick Point Park offers beautiful views of the Bay as well as picnic areas, hiking trails, shoreline fishing sites, and two fishing piers. Depending on the season, fish catches include halibut, shark, striped bass, sturgeon, perch, and flounder. The park features a variety of flowers including the California golden poppy (*Eschscholzia californica*). A good site for winter bird watching, the park also supports owls, crows, hawks, pelicans, egrets, and other species, which can be seen throughout the year.

The park offers special cultural and educational events including guided nature walks, fishing instructions, bird walks, tidepool and mudflat walks, and Bay ecology talks. It was first established during World War II by the U.S. Navy as 170 acres of landfill to be used as a shipyard. After the war, the landfill remained. In 1973, the California legislature set aside \$10 million to purchase the land and, in 1977, it voted to develop the land as the first urban state recreation area.

Thornton State Beach

Thornton State Beach is located at the end of Thornton Beach Road in Daly City, San Mateo County. The length of the Thornton's shoreline is approximately ½ mile long. The Beach is currently closed and is in the process of being transferred from the State to the GGNRA.

2.5 Historic and Cultural Resources

The prehistory and history of San Francisco Bay includes a variety of historical and cultural resources. The Bay and coast were used extensively by Native American groups whose ancestral village sites are located along the Alameda, Contra Costa, Marin, and San Mateo coastlines. These sites were evaluated during the spill by archeologists from the Northwest Information Center on behalf of the State Office of Historic Preservation (SOHP) and were determined not to be at risk. There are many additional historic structures in the cities around the Bay, but these were not affected by the oil spill.

However, vessels at the San Francisco Maritime National Historic Park were oiled. The Park was dedicated on June 27, 1988 and is located at the west-end of Fisherman's Wharf. The park includes the Maritime Museum, Maritime Museum Library, and several historically significant vessels, five of which were oiled by the spill. The cleaning of the oiled vessels and equipment was funded with a separate part of the oil spill settlement and was not part of the NRDA claim.

3.0 INJURED RESOURCES

3.1 Intertidal habitat and shorelines

The Cape Mohican oil spill injured a large variety of habitat and marine life in the Bay and along the California coast. Approximately 120 miles of Bay and California coast shoreline and in-water structures were oiled by the oil spill. An estimated 1,978 acres of shoreline habitat were oiled including 1,294 acres of sandy beach, 516 acres of rocky intertidal habitat, 99 acres of mudflats and wetlands, and 69 acres of riprap and other artificial habitat. The oil also spread to public areas, marinas, piers, seawalls, and other areas of the City of San Francisco. The waterfront between the San Francisco Drydock and Aquatic Park received heavy and continuous oiling. Shoreline oiling in most other areas was in the form of tarballs and tar mats.

3.2 Birds

Approximately 600 birds representing over 40 species were estimated to have died and washed up on beaches as a result of the spill. In addition, field observations during the spill identified several thousand live oiled birds that could not be captured. The trustees believe that many of these birds suffered lethal or sub-lethal affects based on scientific studies of the effects of oil on birds. The birds most affected by the spill were gulls, loons, grebes, cormorants, pelicans, waterfowl, alcids (murrelets, auklets, and related species), and shorebirds including willets, marbled godwits, and western snowy plovers. Fifty-seven live oiled birds were captured and included gulls, loons, cormorants, grebes, and pelicans. Of the birds captured, 34 were cleaned, rehabilitated, and released back to the wild and 23 died in captivity. The released birds included 14 federally endangered brown pelicans.

The number of oiled live or dead birds collected following an oil spill commonly represents only a portion of the number actually affected. Dead birds may then be washed out to sea, scavenged, never found during shoreline search and collection efforts, or live oiled birds may fly out of the spill area before succumbing to the effects of ingested oil or hypothermia. Based on the number of birds collected dead, observations of live oiled birds, and computer simulation modeling, approximately 4,000 birds were adversely impacted by the oil spill. The habitats of many birds species that utilize the Bay and California coast for nesting, foraging, and resting were oiled. Important habitats include wetlands, mudflats, sandy and rocky shoreline, surface water, and intertidal areas, all of which were oiled by the spill.

3.3 Fish, marine mammals, and marine organisms

The Cape Mohican spill oiled Pacific herring spawning habitat in several regions of the Bay within a few weeks of the onset of the spawning event. The physical and chemical characteristics of the spilled oil are such that immediate and long-term injuries to herring were expected. Exposure calculations using pilings and other artificial surfaces along the San Francisco waterfront indicated that 45 acres of the 300 acres of spawning habitat at the waterfront were oiled. It was estimated that 246,900,000,000 (2.469×10^{11}) herring eggs were exposed to oil on these surfaces, which represents approximately 8 percent of the total eggs estimated to have been spawned in the Bay in 1997. Herring injuries included loss of herring embryo viability, contaminated food, and decreased habitat quality.

The spilled oil caused extensive injury to intertidal organisms such as algae, barnacles, snails, and crabs due to smothering by the oil. Where hot water washing of shorelines and structures occurred, the cleaning process likely killed sessile plants and animals not directly impacted by the oil. It was estimated

that injuries to these organisms would occur for several months to years before the natural recovery process occurs. In areas where oil remained, reoccupation of these areas would be slow.

Direct impacts to fin fish were not observed. Significant adverse effects to fish were not expected due to the small fractions of oil expected to have been dispersed into the water column and the dilution caused by waves, tides, and currents during the spill.

Twelve oiled harbor seals were observed, and their conditions were monitored as they moved between Yerba Buena Island and Point Bonita. Their haul out sites at Yerba Buena Island, Point Bonita, and Angel Island also were oiled, but no mortalities due to oil exposure were observed.

3.4 Lost human-use

Substantial adverse impacts on the human-use of public federal, state, and municipal resources and other recreational activities occurred due to the presence of oil on the waters and shorelines of the Bay and the California coast. The oil spill adversely impacted several public facilities and areas including: Golden Gate National Recreation Area, Point Reyes National Seashore, San Francisco Maritime National Historical Park, Angel Island State Park, and Fort Point National Historic Site, Gulf of the Farallones National Marine Sanctuary, Monterey Bay National Marine Sanctuary, and municipal shorelines and waterfronts. Lost human-use of some of these public resources occurred because of the closure of these areas. The quality of visitation by park visitors was also diminished because of shoreline oiling or response operations. The Trustees estimated that total damages resulting from lost human-use and the diminished quality of human-use due to the oil spill ranged from \$1.1 to \$1.4 million.

Portions of Angel Island State Park and GGNRA were closed to visitors during cleanup operations and the quality of visits to these parks was diminished as a result of the spill. Angel Island, located in San Francisco Bay approximately one mile southeast of Tiburon in Marin County was one of the areas most affected by the oil spill. All of the beaches on Angel Island were closed for 10 to 43 days because oil deposited on them during the spill and the public was denied access to these beaches until they were cleaned and declared safe for use. Closure of Angel Island State Park resulted in 4,698 lost or canceled visits by the public, and an additional 535 visits were diminished in value. Six areas at Angel Island State Park were closed for a total of 93 days (Table 3). Human-use damages resulting from both lost and diminished quality of visits at the park was calculated to range from approximately \$161,700 to \$461,700.

Table 3. Angel Island State Park Official Closures.

Area Closed	Duration (days)
China Cove	10 days
Quarry Beach	10 days
Perle's Beach	10 days
Ayala Cove Beach	10 days
West Garrison Beach	10 days
East Garrison Beach	43 days
Total	93

As a result of the oil spill, eleven facilities or areas within the GGNRA were closed between one and six days, and these areas were closed for a total of 44 days as shown in Table 4. Within the GGNRA, Crissy Field Beach was the site most adversely impacted, and approximately 7,000 linear feet of beach and

associated shorelines were heavily oiled. The trustees estimated that 127,904 visits to the GGNRA were diminished in value due to the spill. Human-use damages resulting from both lost and diminished quality of visits at the GGNRA was calculated to be approximately \$938,300.

Table 4. Golden Gate National Recreation Area Official Closures

Area Closed	Duration (days)
Aquatic Park/Municipal Pier	2
Baker Beach	4
China Beach	4
Crissy Field	2
Fort Point Pier	5
Land's End Beaches	5
Ocean Beach	1
E. Fort Baker/Horseshoe Cove	4
E. Fort Baker Fishing Pier	6
Kirby Cove to Point Bonita	6
Rodeo Beach	5
Total	44