4.0 RESTORATION PLANNING

4.1 Restoration Strategy

The goal of the Oil Pollution Act of 1990 (OPA) is to make the environment and public whole for injuries to natural resources and services resulting from an incident involving the discharge or substantial threat of a discharge of oil. OPA recommends that this goal be achieved by returning injured natural resources to their baseline condition and by compensating for any interim losses of natural resources and services which occur during the period of recovery to baseline.

Restoration actions under OPA are either primary or compensatory. Primary restoration is action(s) taken to return injured natural resources and services to baseline on an accelerated time frame. The OPA regulations recommend that trustees consider natural recovery under primary restoration. The trustees may select natural recovery under three conditions: (1) if feasible, (2) if cost-effective primary restoration is not available, or (3) if injured resources would recover quickly to baseline without human intervention. Alternative primary restoration activities can range from natural recovery to actions that prevent interference with natural recovery to more intensive actions expected to return injured natural resources and services to baseline faster than natural recovery.

Compensatory restoration is action taken to compensate for the interim losses of natural resources or services pending recovery. The type and scale of compensatory restoration may depend on the nature of the primary restoration and the level and rate of recovery of the injured natural resources or services given the primary restoration action. When identifying the compensatory restoration components of the restoration alternatives, the trustees should first consider compensatory restoration actions that provide services of the same type and quality and of comparable value as those lost. If compensatory actions of the same type and quality and comparable value cannot provide a reasonable range of alternatives, trustees then consider other compensatory restoration actions that will provide services of at least comparable type and quality as those lost.

When services of the same type and quality and of comparable value can be provided, the OPA regulations prescribe the “service-to-service” scaling approach to determine the appropriate scale of compensatory restoration.

The Trustee Council determined that “services of the same type and quality, and of comparable value” as the lost ecological and recreational services could be provided through appropriate habitat enhancement projects. For this spill, the Trustee Council considered the area affected by the oil, estimates of initial lost ecological and recreational services, and recovery periods of each impacted habitat type. In accordance with the scaling approach, the Trustee Council relied on available data, applicable literature, experience and best professional judgment. Precise scaling calculations are often not possible because knowledge of relevant physical and biological processes is not sufficient. Accordingly, some general assumptions were adopted by the Trustee Council to allow an estimation of scale of restoration necessary to compensate for injuries resulting from this spill.

The Trustee Council developed criteria to evaluate alternative restoration projects identified during the scoping process as well as restoration alternatives identified by the Trustee Council (hereafter collectively referred to as “restoration alternatives” or “projects”). The criteria include relevant federal and state statute provisions governing use of recoveries for natural resource damages.

4.2 Evaluation Criteria

The OPA regulations (*15 CFR 990.54*) recommend that Trustees develop a reasonable range of primary and compensatory restoration alternatives, and then identify the preferred restoration alternatives based on specified selection criteria. The Trustee Council for the Cape Mohican oil spill developed selection criteria separated into two categories, the first being described as "threshold" and the latter described as "additional" criteria. Restoration project alternatives must achieve a minimum level of acceptance on the threshold criteria in order to receive further consideration under the additional criteria. The Trustee Council used the evaluation criteria listed below to consider and prioritize all restoration project alternatives, including alternative projects that were proposed by the public. The criteria are not ranked in order of priority.

Threshold Criteria

Technical feasibility:
The project alternative must be technically sound. The Trustees consider the level of uncertainty or risk involved in implementing the project. A proven track record demonstrating the success of projects utilizing a similar or identical restoration technique can be used to satisfy this evaluation criterion.

Consistency with the Trustees' restoration goals:
The proposed alternative must meet the Trustees' intent to restore, rehabilitate, replace, enhance or acquire the equivalent of the injured natural resources or the services those resources provided.

Compliance with laws:
The proposed alternatives must comply with all applicable laws.

Public health and safety:
The proposed alternative cannot pose a threat to the health and safety of the public.

Additional Criteria

Relationship to injured resources and services:
Projects that restore, rehabilitate, replace, enhance or acquire the equivalent of the resources and services injured by the spill are preferred to projects that benefit other comparable resources or services. The Trustees consider the types of resources or services injured by the spill, the location, and the connection or "nexus" of project benefits to those injured resources.

Avoidance of further injury:
Proposed project alternatives should avoid or minimize adverse impacts to the environment and the associated natural resources. These adverse impacts may have resulted from the original oil spill incident or may be caused in the future by collateral injuries when implementing, or as a result of implementing, the proposed project alternative. The Trustees consider the avoidance of future short-term and long-term injuries as well as mitigating past injuries when evaluating projects.

Likelihood of success:
The Trustees consider the potential for success and the level of expected return of resources and resource services. The Trustees also consider the ability to monitor and evaluate the success of the project; the ability to correct any problems that arise during the course of the proposed project alternative; and the capability of individuals or organizations expected to implement the alternative. Performance criteria should be clear and measurable.

Multiple resource benefits:
The Trustees consider the extent to which the proposed project alternative benefits more than one natural resource or resource service. These benefits are measured in terms of the quantity and associated quality of the types of natural resources or services expected to result from the project.

Time to provide benefits:
The Trustees consider the time it takes for benefits to be provided to the target ecosystem and/or public. A more rapid response to providing benefits is favorable.

Duration of benefits:
The Trustees consider the expected duration of benefits from the proposed project alternative. Projects that provide long-term benefits are favorable.

Protection of alternative:
The Trustees consider the opportunities to protect the implemented alternative and resulting benefits over time through conservation easements, land acquisition, or other types of resource dedication. Long-term protection of the project site and the benefits it provides are favorable.

Opportunities for collaboration:
The Trustees consider the possibility of matching funds, in-kind services, or volunteer assistance, as well as coordination with other ongoing or proposed projects. External funding and support services that reduce costs or extend benefits are favorable.

Benefits relative to costs:
The Trustees consider the relationship of expected resource and service benefits to the expected project costs from each alternative. Trustees seek projects with the least costly (i.e. most cost-efficient) approach to deliver an equivalent type and amount of benefits.

Total cost and accuracy of estimate:
The Trustees evaluate the estimated total cost of each project alternative and the validity of the estimate. The total cost estimate should include costs to design, implement, monitor, and manage the alternative. The validity of cost estimates are evaluated based on the completeness, accuracy, and reliability of methods used to estimate costs, as well as the credentials of the person or entity submitting the cost estimate to accurately estimate costs.

Comprehensive range of projects:
Trustees evaluate the extent to which a project contributes to a more comprehensive restoration package. Proposed project alternatives are evaluated for the degree to which it benefits any uncompensated spill injuries.

4.3 Evaluation of Environmental Restoration Alternatives

To reduce transaction costs and avoid delays in restoration, OPA regulations encourage trustees to conduct the NEPA process concurrently with the development of the Restoration Plan. To comply with the requirements of NEPA, the Trustee Council analyzed the effects of each Proposed Restoration Alternative on the quality of the human environment. NEPA's implementing regulations direct federal agencies to evaluate the potential significance of proposed actions by considering both the context and the intensity of the action. For most of the actions considered in this draft RP/EA, the appropriate context and area of potential significance of the action is regional, as opposed to national or worldwide. Several restoration alternatives included in this section are based on conceptual designs rather than detailed engineering design work or operational plans. Therefore, details of specific projects may require additional refinements or adjustments to reflect site conditions or other factors, and individual projects

may require preparation of additional NEPA/CEQA documents. The Trustee Council assumes that implementation of the restoration projects would begin in 2002.

Following settlement for environmental damage claims for the Cape Mohican oil spill, the Trustees signed an MOU to guide the Restoration Planning and implementation process. The MOU specifies that the settlement will be allocated to four ecological resource categories (birds, fish, wetlands/mudflats, and beaches), and lost recreational use (Table 5). As illustrated in Table 5, except for lost and diminished human-use, the cost of the proposed restoration projects exceeds the amount available for each resource category.

Table 5. Comparison of Settlement Allocation to Proposed Restoration Projects

Resource Category	Available Funds ($)	Proposed Restoration ($)
Wetland habitat	400,000	935,348
Sandy shoreline & rocky intertidal	500,000	869,214
Bird restoration	800,000	1,974,545
Fisheries and water quality	425,000	1,044,217
Lost and diminished human-use	1,030,000	1,030,000
Total	**3,155,000**	**5,853,324**

In accordance with the consent decree, the MOU, OPA, and the Cape Mohican Trustee Council's Resolution, expenditures from the Cape Mohican oil spill restoration fund are limited to restoring injured natural resources and lost or diminished services. To restore injured natural resources and lost human-use of the natural resources that resulted from the Cape Mohican oil spill, the Trustee Council ranked proposed Restoration Alternatives into three Preferred Status categories as follows:

- Highly Preferred
- Moderately Preferred
- Non-preferred.

The Restoration Planning process has resulted in the identification of 16 proposed restoration projects, listed in Table 6, and there are insufficient funds available to implement all of the projects. The Trustees have placed several projects in the non-preferred category due to these financial constraints. In addition, some of the projects in the preferred categories may only receive partial funding. The public is encouraged to provide comments on the projects that it prefers to be implemented. The following section describes 14 Proposed Restoration Alternatives being considered for implementation to compensate for injured natural resources.

Table 6. Summary of Potential Restoration Projects for the Cape Mohican Oil Spill.

Project No.	Restoration Category and Project	Estimated Cost	MOU Status [1]	Preferred Status [2]
	Birds			
1	Shorebird Habitat Protection at GGNRA	$23,500	Y	H
2	California Least Tern Habitat Enhancement at Alameda Point	$141,000	N	M
3	Acquisition, Enhancement, and Management of Red Rock Island	$800,000	Y	M
4	Restoration of Shorebird Foraging Habitat through Control of Exotic Cordgrass in San Francisco Bay Wetlands	$246,000	N	M
5	Farallon Seabird Restoration: a) Exotic vegetation control in nesting areas b) Removal of concrete slabs from nesting areas c) Control of exotic mice	 $143,750 $143,750 $390,195	N	 M N N
6	Restoration of Injured Bird Species through Native Vegetation Restoration at Marin Islands NWR	$86,350	N	N
	Fisheries and Water Quality			
7	Pacific Herring Spawning Habitat Enhancement in San Francisco Bay	$456,597	N	H
8	Wetland Restoration at Pier 98, India Basin, San Francisco	$146,920	N	H
9	Steelhead Stream Habitat Enhancement at San Francisquito Creek	$40,000	N	H
10	Wetland and Water Quality Enhancement at Pier 94	$400,700	N	N
	Wetlands and Mudflats			
11	Giacomini Coastal Wetlands Restoration Project	$435,348	Y	H
12	Hamilton Wetlands Restoration	$500,000	N	N
	Sandy Beach and Rocky Intertidal Habitat			
13	Sandy Beach Habitat Restoration at PRNS	$303,214	Y	H
14	Protection of Duxbury Reef Through Education	$566,000	Y	H
	Human-use			
15	Angel Island Foot Trail Enhancement	$180,000	Y	H
16	Crissy Field Habitat Stewardship Program	$850,000	Y	H
	TOTAL	**$5,853,324**		

[1] A 'Y' means the trustees relied on the project to develop the damage claim and agreed in a Memorandum of Understanding to consider the project during development of the Restoration Plan if the project is feasible. A 'N' means the trustees did not rely on the project to develop the damage claim.

[2] H – highly preferred project, M- moderately preferred project, N – non-preferred project.

4.3.1 BIRD RESTORATION

4.3.1.1. #1 – Restoration Alternative: Shorebird Habitat Protection at Golden Gate National Recreation Area

Project Description

Trustee analysis of injuries to wildlife indicates that approximately 4,000 birds were impacted by the Cape Mohican oil spill. The majority of these oiled birds observed during the oil spill were shorebirds, including: willets, western sandpipers (*Calidris mauri)*, marbled godwits, sanderlings (*Calidris alba)*, dunlin (*Calidris alpina)* and the federally threatened western snowy plover. A substantial number of these oiled birds were observed on Ocean Beach within GGNRA. Two primary causes for declines in shorebird populations include the loss or degradation of sandy beach habitat (e.g., from development and invasion of non-native plants), and disturbance by humans. Habitat protection and public outreach, as described below, is very effective at reducing human-related disturbance to shorebirds.

The restoration project will be implemented at Ocean Beach. Ocean Beach is approximately 4 miles long and is located within the city and county of San Francisco and entirely within GGNRA. It is an important site for shorebird resting and foraging activities and provides habitat for tens of thousands of wintering and migrating shorebirds, including western snowy plovers, which inhabit the beach for up to 10 months of the year. This restoration project entails improving habitat protection by reducing the level of human-caused disturbance to wintering and migratory shorebirds.

The GGNRA installed 12 interpretive and regulatory signs at major beach entrances to inform the public of the presence of western snowy plovers and other shorebirds, and their vulnerability to disturbance by humans and recreational activities. An interpretive bulletin on protecting western snowy plovers, shorebirds and sandy beach habitat also was published. Due to insufficient funds, however, GGNRA has been unable to update and replace damaged or missing signs, or update and reproduce interpretive bulletins. This project component will allow updating and replacement of damaged or missing signs and re-printing of interpretive bulletins for up to 10 years. The project includes costs for design and text changes that may be required.

Restoration Objectives

This restoration project is intended to achieve improved habitat protection and reduce disturbance to wintering and migratory shorebirds at Ocean Beach. This objective will be accomplished by reducing disturbance of shorebirds from human recreation. This project involves public outreach. The public outreach project will increase protection of shorebirds and enhance visitor understanding of the importance of urban beach habitat for wintering and migratory shorebirds through the use of signs and educational bulletins.

Scaling Approach

Numerous shorebirds, including the federally threatened western snowy plover, were observed to be oiled during the spill. Ocean Beach provides important habitat for wintering and migratory shorebirds for foraging and resting, important for building necessary fat reserves for migration and reproduction.

This project will compensate for impacts to shorebirds not addressed by the enhancement and restoration tasks of other projects.

There are numerous site-specific environmental and human-related factors that influence shorebird survival and reproductive success. These include factors such as human disturbance, predation, invasive non-native vegetation, weather, natural events, oil spills and other contamination. It is difficult to measure productivity fluctuations based on modifications to only one of these influencing factors. The Trustees have not quantified the extent of potential benefits that will result from this habitat protection action. This project, however, will aid in reducing human-related disturbance to wintering and migrating shorebirds.

Although it is proven that public outreach programs are effective, it is very difficult to quantify the benefits. Based on the results of similar projects and best professional judgement of the Trustees, this scale of habitat protection and public outreach undertaken to protect shorebirds and enhance visitor understanding of the importance of urban beach habitat for shorebirds is expected to compensate for injuries to shorebirds.

Probability of Success

The probability of success for this habitat protection project is high. Implementation of similar shorebird management/outreach programs have been successful in increasing shorebird protection and in enhancing understanding by the public. The Trustees expect that similar benefits will be accomplished through this project.

Success Criteria and Monitoring

The success criterion will be the reduction in incidence of disturbance to shorebirds, production of public education bulletins, and placement of interpretive signs on Ocean Beach. As part of this project, the Trustees will continue to monitor disturbance impacts on wintering and migrating shorebirds at Ocean Beach.

Approximate Project Cost

Habitat Protection at Ocean Beach

Expenditure	**Quantity**	**Unit Cost**	**Total Cost**
Replacement of Interpretive Signs Over 10 Years			
Wooden frames and plexiglass covers	50	$275	$13,750
Interpretive panels	50	$65	$ 3,250
Minor re-design and text updates	5	$250	$ 1,250
Reprinting of Interpretive Bulletins			
5,000 copies of 4-color, 2-sided, folded (3 printings @ $1500 each)	3	$1500	$ 4,500
Minor re-design and text updates of interpretive bulletin	3	$250	$ 750
Total Project			**$23,500**

Environmental Consequences

This project will result in environmental benefits by reducing the level of human-caused disturbance to wintering and migrating shorebirds, including the federally threatened western snowy plover, in a national park. Because this project provides for continuation of an existing program, the project is not expected to result in any significant adverse environmental impacts.

Evaluation

Ocean Beach provides important resting and foraging habitat for wintering and migrating shorebirds, including western snowy plovers. Shorebird feeding patterns and resting behavior have been adversely affected by human and domestic animal disturbance. Increased habitat protection and public outreach are practical and effective methods to improve conditions for shorebird resting and foraging, and have been successfully implemented at Ocean Beach and other sites in California. Although accurate quantification of the success and benefits of this project is difficult, this project is expected to be successful in reducing human disturbance to shorebirds at Ocean Beach.

The Trustees evaluated this project against all Threshold and Additional screening criteria developed to select restoration projects and determined that this project is consistent with these selection factors. The Trustees determined that this type and scale of restoration will effectively provide appropriate compensation for injuries to shorebirds that occurred as a result of the oil spill.

4.3.1.2. #2 - Restoration Alternative: California Least Tern Habitat Enhancement at Alameda Point

Project Description

At the time of the oil spill, California least terns that nest in San Francisco Bay were wintering in Central America and, therefore, this species was not directly impacted by the Cape Mohican oil spill. However, the shoreline areas near their nesting habitat at Alameda Point were oiled. California least terns are listed as a federal and state endangered species. Because of their special status, California least tern habitat enhancement at Alameda Point is proposed as a surrogate for injuries that occurred to several species of gulls and terns including Bonaparte's gulls (*Larus philadelphia)*, California gulls (*Larus californicus)*, glaucous-winged gulls *(Larus glaucescens)*, Heermans's gulls *(Larus heermanni)*, herring gulls (*Larus argentatus*), mew gulls (Larus canus), ring-billed gulls (*Larus delawarensis*), western gulls, Caspian terns *(Sterna caspia*), elegant terns *(Sterna elegans)*, and Forster's terns (*Sterna forsteri)*.

The California least tern colony at Alameda Point is the northernmost breeding colony along the California coast and the only substantial colony in San Francisco Bay. For the past 10 years, the colony has achieved high reproductive success and has an increasing number of breeding pairs. In several years, the colony size has the potential to expand beyond the suitable nesting habitat currently available at the site if additional and suitable offsite habitat is available.

The project will create new nesting habitat to accommodate approximately 150 additional pairs of terns, which will increase the carrying capacity of this colony site by 60 percent. The current colony consists of approximately 250 pairs. The current 4-acre colony site will be enlarged to 6 to 8 acres. Suitable nesting substrate (e.g., pea gravel and oyster shell) will be added along the side of the existing colony site. The shape of the site will be altered from the current triangle to a rectangle or oval to eliminate the confining triangle corners. Maintenance of the newly created habitat will consist of the removal of undesirable vegetation and addition of pea gravel where needed. This 3-year project will fund annual maintenance activities, which will take place each year prior to tern arrival. In subsequent years, maintenance will be incorporated into general refuge operations funding. The project will be conducted at Alameda Point, within the proposed boundaries of the Alameda National Wildlife Refuge in Alameda, California (Figure 2).

Restoration Objectives

The objective of this project is to increase the size and productivity of the California least tern colony at Alameda Point. This will be accomplished by expanding the amount of suitable habitat currently available to terns through habitat enhancement methods described above.

Scaling Approach

The Trustees estimate that between 130 and 150 additional California least tern nests will occur as a result of creating an additional 2 to 4 acres of suitable nesting habitat. The Trustees believe that the amount of increased nesting and productivity expected to result from this project will provide appropriate compensation for injuries to 11 species of terns and gulls.

Although difficult to predict precisely, the Trustees expect increased reproductive success to occur as a result of predator control measures instituted as part of this project.

Probability of Success

The probability of success for this project is very high. The nesting habitat requirements of California least terns are well known, and habitat enhancement methods prescribed for this project have proven to be

successful in other projects. Similar projects to enhance nesting habitat have successfully increased colony size and productivity. The addition of the White Beach habitat enhancement at Camp Pendleton, California, has increased the fledgling production (Chris Bandy, personal communication). Similar habitat management practices implemented at the Alameda Point colony site are expected to have similar success.

Success Criteria and Monitoring

To consider the program a success, it must produce 100 active nest initiations at the Alameda Point colony within six years of project initiation. Creation and maintenance of suitable habitat for three years will also be a criterion for project success. To evaluate and document the success of the project, a monitoring program to assess habitat conditions and nesting increases will be conducted for three years and again at six years.

Approximate Project Cost

Expenditure	**Total Cost**
Fencing (1,200 feet @ $10/ft.)	$ 12,000
Shell and pebbles (1,600 cu yds. @ $46/cu yd)	$ 73,600
Environmental compliance & Project management	$ 5,500
Monitoring (3 mos./yr. for 3 yrs. @ GS-5 rate)	$ 20,000
Maintenance of habitat & fence ($10,000/yr. for 3 yrs.)	$ 30,000
TOTAL	**$141,000**

*Note: After three years monitoring and maintenance will be incorporated into normal operations.

Environmental Consequences

Vegetation removal and placement of pea gravel will be conducted during the non-nesting season. The effectiveness of the 3- to 4-foot tall fence will be monitored. If unacceptable adverse impacts result to predators, modification to the fence will be evaluated. The project is not expected to have any significant adverse environmental or economic impacts.

Evaluation

Implementation of this project will result in positive benefits by increasing the amount and quality of least tern nesting habitat at Alameda Point. Habitat enhancement is the only practical means available to increase the size of the Alameda Point California least tern colony and has proven to be successful in the past. Monitoring of the colony site will enable agency biologists to assess and document the success of the project. No significant adverse environmental or economic impacts are expected to occur as a result from this project.

The Trustees have evaluated this project against all Threshold and Additional screening criteria developed to select restoration projects and concluded that this project is consistent with these selection factors. The Trustees determined that this type and scale of restoration will effectively provide appropriate compensation for injuries to terns and gulls that occurred as a result of the oil spill.

4.3.1.3. #3 – Restoration Alternative: Acquisition, Enhancement and Management of Red Rock Island

Project Description

Trustee analysis of injuries to wildlife indicates that approximately 4,000 birds were impacted. The most direct evidence of acute injury is reflected in the documentation of dead and live stranded birds. It is estimated that 593 birds were killed and of these, 80 percent were seabirds. The predominant bird species killed were loons, grebes, pelicans, cormorants, gulls and alcids. San Francisco Bay is a critical area for waterbirds to nest, forage, and roost. Oil contamination in San Francisco Bay extended as far north as the Richmond-San Rafael Bridge and came within close proximity of Red Rock Island and other islands that support colonial nesting waterbirds. As a result, two sensitive seabird species suffered significant injuries including the California brown pelican (federally listed) and the double-crested cormorant *(Phalacrocorax auritus)* (California Species of Special Concern).

This project would provide direct in-kind, on-site compensation and replacement of ecological services through the creation or enhancement of seabird nesting and roosting habitat consistent with the injuries that were claimed by the trustees. This project served as the basis for the settlement and Red Rock was incorporated as a Preferred Project.

Project Description

The project would be conducted at Red Rock, which is a 9-acre island located in San Francisco Bay approximately 2 kilometers south of the Richmond-San Rafael Bridge at the intersection of San Francisco, Marin, and Contra Costa counties. This project proposes to accomplish several things to benefit waterbirds resources of San Francisco Bay including: (1) provide funding to acquire the island to ensure protected habitat; (2) create and enhance nesting habitat for several waterbird species impacted by the spill, including double-crested cormorants; (3) establish a breeding bird monitoring program; (4) create protected and suitable roosting habitat for the California brown pelican; (5) provide educational materials to the public regarding the valuable natural resources on Red Rock Island; and (6) provide for enforcement and management efforts.

At this time the California Department of Fish and Game is exploring a variety of options for acquisition and long-term management of the Island. Thus far, the National Audubon Society has indicated their interest in participating in or coordinating this project (Personal communication, Dan Taylor, National Audubon). The specific details of this potential collaboration are being explored.

The proposed project will enhance and create new nesting habitat through vegetation management, including eradication of non-native species. Coyote brush of other native shrubs will be planted to provide new nesting substrate. Some wooden nesting platforms would be constructed to accelerate re-colonization by cormorants.

Social attraction techniques which have been used successfully to restore seabird colonies at several other locations in the nation, will be employed to attract and establish a double-crested cormorant nesting colony on Red Rock Island and encourage pelican roosting. This will entail the use of decoys and recordings of courtship vocalizations.

Human disturbance from boaters and fisherman who currently use the island cause problems for nesting waterbirds, therefore, this project includes measures to control human-use of the island. This would be accomplished in part through public outreach and education. Signs placed at key marinas and boat launch ramps would enlist the public support in complying with restrictions on landing on the Island and provide information on the sensitivity of the habitat and the wildlife. Pamphlets would target boaters, sea

kayakers, and other user groups. Enforcement personnel would contact boaters and fisherman to reinforce awareness of restrictions. Signs on the island and seasonal placement of buoys would make the public aware of closures and restriction.

Restoration Objective

There are several objectives of this proposal. Supporting details are provided below. The first objective is to increase the productivity and population size of colonial nesting waterbirds, particularly double-crested cormorants, in San Francisco Bay. Two hundred cormorant nests will be established in five years. The double-crested cormorant is a fish eating diver that has historically occurred as a resident breeding species in marine, estuarine, and fresh waters along the California coast. Over the last century, it has experienced a population decline, probably due to pesticides and human disturbances, at 37 coastal and island breeding colonies. At Southeast Farallon Island, for example, thousands of double-crested cormorants nested in the mid-1800's, but only about 50 nests remained by 1972. Breeding populations increased on the island (250 nests in 1991) and elsewhere in California in the 1980's and 1990's and were estimated at about 5,000 breeding pairs by 1991 (*Carter et al., 1992*).

In San Francisco Bay, cormorant colonies are located on the Bay Bridge, the San Rafael-Richmond Bridge, and in the Napa salt ponds. None of these sites are considered to have long term security. For example, the Bay Bridge Colony, with 794 nests in 1999, will be lost due to the scheduled rebuilding of the bridge structure. It is unclear whether cormorants will be accommodated on the new structure, as conflicts over design, bridge maintenance activities and concerns about collisions between cormorant fledglings and autos would likely continue. This example shows that man made structures are temporary opportunities at best, and illustrates the need for more secure nesting areas. The Red Rock Island project fills this need by establishing natural nesting habitat for cormorants and other colonial nesting birds.

The second project objective is to provide protected, disturbance free roost sites for brown pelicans and other waterbirds. San Francisco Bay is an important post-breeding dispersal area for California brown pelicans. Other than protecting foraging habitat and pelican food resources the most important management tool available for pelican management in San Francisco Bay is the creation/protection of roosting habitats. This is the only project proposed that addresses injuries to this Endangered Species. Specifically, this project seeks to enhance, create, and protect roosting habitat.

Communal roost sites are essential habitat for brown pelicans (*Gress and Anderson 1983, Jaques 1994*). Brown pelicans are unlike many other seabirds in that they have wettable plumage (*Rijke, 1970*). Their feather structure is such that they will take on water, become soaked to the skin, and hypothermic if they do not come ashore regularly to dry out and restore their plumage. Brown pelicans are also among the earth's heaviest flying birds (*Pennycuik, 1972*). They have evolved a series of behavioral adaptations to conserve energy in flight, and spend a large portion of their daily time budget resting onshore at terrestrial roosts. Roost site selection is based on proximity to prey resources, isolation from potential predators and human disturbance, and microclimate features that aid in thermoregulation. Pelicans spread out at a larger number of roosts by day and gather into a smaller number of traditional night roosts at dark, when they are more vulnerable to mammalian predation. An island-type habitat like Red Rock is generally required at night. Major night roosts may support hundreds to thousands of pelicans on a given night (*Briggs, 1987; Jaques and Anderson 1988; Jaques et al. 1996*).

Improvements in the network of communal roosts in San Francisco Bay will have a positive influence on the energy budgets of pelicans by reducing energy costs associated with (1) commuting between prey and roosts, (2) flushing and relocating due to human disturbance, and (3) use of sub-optimal microclimates within roosts. Pelicans migrating along the California mainland will also benefit from increased availability, quality, and capacity of a new stopover site. Cumulative energy reductions will result in

improved body condition of individual birds. Population-level effects from improving the condition of individual birds should include increased juvenile and adult survival.

Pelican distribution and abundance in San Francisco Bay varies according to stage in the breeding cycle, breeding success, influx of birds from Mexico, large-scale migration patterns along the Pacific coast, distribution and abundance of prey, and roost site availability (*Anderson and Anderson, 1976; Briggs, et al., 1981; Anderson and Gress, 1983; Jaques, et al., 1996*). Briggs et al. (*1981*) found that distance to the nearest large roost was perhaps the most important factor governing pelican distribution along the shore. Currently the availability of roost sites limits the foraging range of brown pelicans and may limit the carrying capacity of San Francisco Bay. Prior to intensive human settlement and alteration within the Bay, brown pelicans would have had ample, suitable sites for roosting within wetlands, on sandy beaches, rocky shorelines, and islands. The loss of habitat from human encroachment has been somewhat offset by the addition of artificial structures, such as jetties, breakwaters, and floating structures. Pelicans now rely heavily on these types of structures for roost sites. Artificial structures were found to support about 65 percent of all pelicans roosting along the mainland (*Jaques, et al., 1996*). Few roosts along the mainland fall under the jurisdiction of natural resource agencies; several major roost sites on privately owned structures have been lost in recent years, and human disturbance at many existing roost sites is high.

The third objective is to educate the public regarding the sensitive and valuable natural resources at Red Rock, and the fourth objective is to minimize human disturbance. Red Rock offers a unique opportunity to enhance seabird nesting and roosting habitats especially for double-crested cormorants and California brown pelicans. As the last remaining privately owned large island in central San Francisco Bay, it has been subjected to a long history of human disturbance including mining operations and intermittent human residence. In recent years, unauthorized human visitors have undoubtedly caused the greatest problems for the nesting birds. Even occasional human intrusions on the island would dramatically reduce nesting habitat values. In spite of these problems, some seabird nesting and roosting values have persisted. The island supports one of the largest western gull colonies in the Bay as well as smaller numbers of nesting snowy egrets (*Egretta garzetta*) and black-crowned night herons *(Nycticorax nycticorax)* (*Schoenherr, A.A., C.R. Feldmeth, and M.J. Emerson, 1999. Natural history of the islands of California. California Natural History Guides, 61. Univ. of California Press, Berkeley, California*). Black Oystercatchers *(Haematopus bachmani)* and Canada geese (*Branta canadensis*) have also nested on the island. Prior to human disturbance, harbor seals were observed hauling out. Harry Carter (pers. comm.) observed California brown pelicans, Brandt's cormorants, pelagic cormorants, and double-crested cormorants roosting on the island. The establishment of a managed island seabird colony would ensure long-term stability for these important San Francisco Bay natural resources.

Scaling Approach

During the settlement process, the trustees estimated that within five years, with appropriate management and enhancement actions, 200 nests of double-crested cormorants could be established on Red Rock. Recolonization by double-crested cormorants would encourage roosting by California brown pelicans and possibly nesting by Brandt's cormorants. The existing Western gull, snowy egret and black-crowned night heron colonies would be protected and enhanced. The trustees estimated that the benefits to waterbirds at Red Rock would approximately replace the ecological services lost due to spill injuries to waterbirds and seabirds in particular.

Probability of Success

The probability of success for this project is high. Steven Kress, of the National Audubon Society, has successfully utilized similar seabird colony management and social attraction techniques with terns, tubenoses, alcids, and more recently with pelecaniforms (gannets; *personal communication, March 26, 2001*). Kress believes the proximity of an existing double-crested cormorant colony (Richmond Bridge) and the existing gull, heron, and egret colonies at Red Rock, will facilitate

recolonization by double-crested cormorants and encourage pelican roosting. In many respects this project is more straightforward than the nearby successful Devil's Slide common murre recolonization project. At Devil's Slide, murres nested in the first year of the project.

Success Criteria and Monitoring

The success criteria for this project will be the establishment of a double-crested cormorant colony on Red Rock, the attraction of roosting brown pelicans, and the enhancement of the existing Western gull, black-crowned night heron, and snowy egret colonies. Success will be determined through a monitoring program similar to that used in the Devil's Slide monitoring program.

Approximate Project Cost

The following table describes a cost estimate to implement a five-year project to acquire, enhance, and protect seabird-nesting habitat at Red Rock. Cost estimates were derived from actual expenses incurred by the trustee agencies for similar projects including the Apex Houston murre recolonization project and US Fish and Wildlife expenses associated with the operation of the Oregon Coast National Wildlife Refuge. Additional cost information was obtained from the National Audubon Society.

Phase	**Expenditure**	**Total Cost**
Phase I	Appraisal	Completed
Phase II	Acquisition	**$350,000**
Phase III	Development of Management Plan	**$5,000**
Phase IV	Public Education and Enforcement	
	Signs 4 ft x 8 ft (4)	$6,000
	Signs 24 in x 24 in and posts (16)	$800
	Pamphlets and Fliers	$2,000
	Boat Patrol and public contact ($18,240/yr)	$91,200
	Total (over 5 years)	**$100,000**
Phase V	Nesting Habitat Enhancement	
	Exotic plant control (2 years): Labor (CCC)	$8,000
	Native plantings (3 years): Materials & Labor	$32,500
	Cormorant nesting platforms (20): Materials, Construction, and Installation	$4,500
	Total (over 3 years)	**$45,000**
Phase VI	Social Attraction and Monitoring Program	
	Decoys (100 @ $60 ea.)	$6,000
	Sound system (batteries, solar panel, CD player)	$4,500
	Salaries and benefits (1 full time biologist/5yrs)	$225,000
	Salaries and benefits (1 seasonal part-time/5 yrs)	$64,500
	Total (over 5 years)	**$300,000**
	Total	**$800,000**

Environmental Consequences

The project will provide positive benefits to nesting and roosting waterbirds in San Francisco Bay. The project will protect, enhance and restore additional nesting habitat for double-crested cormorants, black-crowned night herons, snowy egrets, and western gulls. It will provide important roosting habitat for California brown pelicans and other waterbirds. The island will provide additional habitat for these birds should they ever be forced from the bridge nest sites or from other Bay islands. Removal of exotic vegetation and the restoration of native flora will enhance the island ecosystem. All construction and vegetation management work will be done when birds are not nesting during periods of low wildlife use. Potential short-term adverse environmental impacts will be limited to intermittent disturbance during construction and re-vegetation phases. No significant adverse economic impacts are anticipated to occur as a result of this project.

Evaluation

This project would provide direct in-kind, on-site compensation and replacement of ecological services through the creation and enhancement of seabird nesting and roosting habitat consistent with injuries to specific waterbirds and seabirds that were claimed by the trustees. The probability of success for this project is high. Other restoration projects throughout the nation have successfully utilized similar seabird colony management and social attraction techniques with terns, tubenoses, alcids, and more recently with pelecaniforms (gannets). The proximity of an existing double-crested cormorant colony (Richmond Bridge) and the existing gull, heron, and egret colonies at Red Rock, will facilitate recolonization by double-crested cormorants and encourage pelican roosting. Cost estimates have been derived from actual expenses incurred by trustee agencies for similar projects and are therefore thought to be practical and cost-effective. No long-term adverse environmental or economic impacts are expected to result from this project.

This project served as the basis for the settlement and was incorporated as a Preferred Project. The Trustees evaluated this project against all Threshold and Additional screening criteria developed to select preferred restoration projects and concluded that this project is consistent with these selection factors. The Trustees determined that this type and scale of project would effectively provide appropriate compensation for waterbirds injured as a result of the oil spill.

4.3.1.4. #4 – Restoration Alternative: Restoration of Shorebird Foraging Habitat through Control of Exotic Cordgrass in San Francisco Bay Wetlands

Project Description

The Cape Mohican oil spill impacted 99 acres of intertidal mudflat habitat that was used extensively by shorebirds as foraging habitat. The majority of the estimated 4,000 oiled birds observed during the oil spill were shorebirds, including willets and marbled godwits. As described below, habitat restoration and protection is a preferred restoration alternative for these shorebird impacts. In San Francisco Bay, intertidal mudflats and tidal salt marshes provide essential foraging areas for large numbers of shorebirds, between 500,000 to 1 million, that migrate through or winter in the Bay annually. These habitats are also important to wintering waterfowl and other waterbirds for foraging, and to many fish species as spawning and nursery habitat.

Throughout San Francisco Bay, exotic smooth cordgrass (*Spartina alterniflora*) has invaded habitats including: intertidal mudflats, suppressing algae and eelgrass; tidal salt marsh plains, replacing native marsh plants such as pickleweed and Pacific cordgrass (*Spartina foliosa*); and tidal marsh sloughs, decreasing intertidal shorebird foraging areas and increasing sedimentation, which eventually reduces tidal flow. As a result, important native habitat for shorebirds, waterbirds, waterfowl, and marine organisms is lost or its quality is lowered, which results in reduced diversity and abundance of these species. Mudflats in the project area function as high-use shorebird foraging areas, and control of smooth cordgrass in this area will result in substantial benefits for shorebirds.

This project involves eradication of smooth cordgrass from mudflats and tidal salt marshes in the central and south portions of San Francisco Bay, between the Bay Bridge and the Dumbarton Bridge. Control methods include hand pulling, hand mowing, and application of Rodeo herbicide. Natural revegetation will be allowed to occur after control measures are implemented. The work will be conducted between June and November each year, prior to smooth cordgrass seed-set for maximum effectiveness. Landowners of smooth cordgrass invaded marshes, qualified contractors working for these landowners, or other parties who obtain landowner permission will conduct the control work.

Restoration Objectives

The objective is to remove smooth cordgrass from intertidal mudflats to create conditions that will provide native vegetation (e.g., algae and eelgrass) an opportunity to naturally revegetate. In fact, microalgae provide the basis for the estuarine food web, forming dense patches on mudflats and representing a readily available food source for invertebrates (e.g., worms and clams) that are then consumed by shorebirds and waterfowl.

Removal of smooth cordgrass from tidal marshes and tidal sloughs will allow native plants to reestablish on the tidal marsh plain, and will restore shorebird foraging and fish nursery habitat in the tidal sloughs. As a result, this project will increase the amount of productive native foraging habitat available to wintering and migrating shorebirds and wintering waterfowl, and should enhance the condition, survival, and productivity of these species.

Scaling Approach

The project will restore intertidal mudflat similar to that injured in the spill. The restored habitat will benefit shorebirds, waterfowl, and other waterbird species as well as marine animals throughout San Francisco Bay.

Probability of Success

The probability of success for this project is high. Herbicide control of smooth cordgrass conducted in south San Francisco Bay by San Francisco Bay National Wildlife Refuge and East Bay Regional Park District has resulted in 75 to 95 percent control effectiveness after only one year of control, and nearly complete control in three years, with retreatment. Hand mowing and hand pulling are less effective and much less time and money efficient, but these methods will be used when herbicide application is not advisable or necessary. It is likely that similar results will be achieved with the proposed project.

Success Criteria and Monitoring

In order to ensure successful eradication of exotic cordgrass, control measures will continue for three years. Control areas will be monitored and repeated the following year as necessary. Biologists will establish monitoring transects, quadrats, and photopoints in the control areas, and will collect baseline data prior to implementing the control project. Each spring (after control is initiated), vegetation monitoring will be conducted and photographs will be taken at each established photopoint to determine the success of the control program. In addition, the project area will be searched for new smooth cordgrass invasions, which will then be targeted for control. The project will be determined successful if complete control of cordgrass is achieved within three years of project initiation.

Approximate Project Cost

Table 1 presents the approximate project cost for a 3-year program to restore and protect 100 acres of intertidal mudflat and tidal salt marshes. Smooth cordgrass control includes labor, equipment, materials, project management, and monitoring. Labor includes hiring a contractor (with a truck-mounted sprayer) to conduct herbicide application, backpack spraying, or hand mowing. Equipment necessary for the control consists of hand-mowers and backpack sprayers. Materials include herbicide (Rodeo), surfactant, and indicator dye. Monitoring will be conducted by a field technician. Environmental compliance and project management will be conducted by a biologist from Don Edwards San Francisco Bay NWR.

Table 1. Estimated Cost to Control Smooth Cordgrass

Expenditure	1st Year	2nd Year	3rd Year	Total Cost
Labor ($100/hr for 2 person crew @ 4 hours/acre)	$40,000	$20,000	$10,000	$70,000
Materials (herbicide @ $800/acre)	$80,000	$40,000	$20,000	$140,000
Equipment (mowers, backpack sprayers, protective gear)	$2,000	$1,000	$1,000	$4,000
Project Management (GS-11: 2 mo. Yr 1, 1 mo. in Yrs. 2 and 3)	$8,500	$4,250	$4,250	$17,000
Monitoring (2 mo. @ GS-5/Year)	$5,000	$5,000	$5,000	$15,000
TOTAL	**$135,500**	**$70,250**	**$40,250**	**$246,000**

Environmental Consequences

This project will result in positive benefits by restoring high-quality shorebird foraging habitat in San Francisco Bay. No significant adverse environmental or economic impacts are expected to result from this project.

To minimize the potential for impacts to native wildlife in the control areas, control work will not be conducted during nesting season for the endangered California clapper rail (which resides in the tidal marshes) or during native fish spawning season, unless these species do not inhabit the control area. In addition, disturbance to wildlife and habitat will be minimized during all control work. The type of control method to be used will be determined on a site-specific basis, depending on extent of smooth cordgrass invasion, access, and landowner input.

Potential impacts of a large scale, San Francisco Bay-wide control program are currently being assessed by the "Invasive Spartina Project," managed by the California Coastal Conservancy. An environmental document, an EIS/EIR, is currently being written to fulfill NEPA/CEQA requirements and U.S. Fish and Wildlife Service is being consulted on potential endangered species impacts. The proposed project activities will be covered under this program.

Evaluation

Restoration of shorebird foraging habitat offers an effective means of increasing the survival of wintering and migrating shorebirds. This proposed control method for smooth cordgrass has been proven to be effective in restoring invaded intertidal areas. The project will restore a habitat similar to the one that was injured and will achieve an important conservation goal.

4.3.1.5. #5 - Restoration Alternative: Farallon Seabird Restoration Projects

Project Description
Three separate restoration projects were considered within this Restoration Alternative:

A. Exotic Vegetation Control in Nesting Areas

B. Marine Terrace Habitat Restoration

C. Control of Exotic Mice

The restoration projects are presented under one Proposed Restoration Alternative because they have the same restoration objective, which is to restore burrow-nesting seabirds injured due to the oil spill, through the restoration of burrow nest habitat. The projects are identified separately because they use different methods to achieve the restoration objective, and have different preferred status (Table 6).

Trustee analysis of impacts to resident and migratory waterbirds indicated that of the 593 estimated birds lost, 80 percent were waterbirds. Seabird species injured included loons, grebes, pelicans, cormorants, alcids, and tubenoses. The impacts occurred in San Francisco Bay and the marine environment of the adjacent California coast. As described below, habitat creation and protection is a preferred restoration alternative for seabird injury.

The Farallon Islands comprise the largest seabird nesting colony complex on the Pacific Coast of North America south of Alaska. Populations of seabirds such as rhinoceros auklet (*Cerorhinca monocerata)*, Cassin's auklet, and ashy storm-petrel (*Oceanodroma homochroa*) have declined in recent years. Exotic plants, including New Zealand spinach *(Tetragonia tetragonioides*) and *Malva* spp. have become established on Southeast Farallon Island and are potentially detrimental to nesting seabirds. More recently, non-native grasses have also begun invading prime seabird nesting habitat. These non-native species are extremely invasive and out-compete the endemic Farallon weed (*Lasthenia maritima*), an important seabird nest-building material. Exotic species also tend to be perennial, and consequently obstruct nesting crevices. In contrast, the native Farallon weed dies back during the nesting season, allowing seabirds access to crevice and soil nesting areas.

Southeast Farallon Island was formerly used as a base for lighthouse operations and military activities and a number of buildings and dwellings were constructed to support these uses. Obsolete buildings have been removed, but concrete foundations, walkways, and pads remain. These paved areas occur on the marine terrace and reduce the amount of deep soil habitat available for burrow-nesting seabirds, such as Cassin's and rhinoceros auklets. The house mouse (*Mus musculus*) is an introduced species to the Farallon Islands as a result of human activities. Mice can be an effective predator of eggs and chicks of small seabirds, such as storm-petrels and auklets. Mice have a more serious indirect effect on seabirds by causing predatory owls to overwinter. Owls do not breed on the island, but dispersing individuals arrive in fall when mouse populations are high, and when mice populations decline in late winter, owls switch their diet to seabirds. Cassin's auklets and ashy storm-petrels, eaten by owls, are declining at an alarming rate on Southeast Farallon Island. This Restoration Alternative consists of three separate projects that will be implemented on Southeast Farallon Island to restore burrow-nesting seabirds and are described below.

A. Exotic Vegetation Control in Nesting Areas

This restoration project involves the control of exotic vegetation. The primary species of concern are non- native New Zealand Spinach and *Malva* spp. A combination of chemical and mechanical methods