Stuyvesant/Humboldt Coast Oil Spill

Final Damage Assessment and Restoration Plan/ Environmental Assessment

June 2007

Prepared by:
California Department of Fish and Game
California State Lands Commission
United States Fish and Wildlife Service

Executive Summary

On September 6, 1999, the dredge *M/V Stuyvesant* (the *"Stuyvesant"*) spilled at least 2100 gallons of Intermediate Fuel Oil 180 (IFO-180) into the Pacific Ocean near the mouth of Humboldt Bay, near Eureka, California (the "Spill"). The federal Oil Pollution Act of 1990 (OPA) (33 U.S.C. §§ 2701, et seq.) and California's Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (the "California Act") (Gov. Code §§ 8670.1, et seq.), establish liability for natural resource damages, requiring responsible parties to make the environment and the public whole for the injury, destruction and loss of natural resources and services resulting from oil spills into navigable and/or marine waters. The following agencies are designated natural resource trustees (the "Trustees") under OPA and/or State law, for natural resources injured by the Stuyvesant oil spill: the California Department of Fish and Game (CDFG); the California State Lands Commission (CSLC); and the United States Fish and Wildlife Service (USFWS). As a designated Trustee, each agency is authorized to act on behalf of the public under state and/or federal law to assess and recover natural resource damages and to plan and implement actions to restore, rehabilitate, replace, or acquire the equivalent of the affected natural resources injured as a result of a discharge of oil.

Damage Assessment and Restoration Plan/Environmental Assessment (DARP)

The Trustees have prepared this DARP, describing the injuries resulting from the Spill and proposing restoration alternatives. This plan was developed, in part, through cooperative studies with Bean Stuyvesant LLC and Bean Dredging, LLC (collectively, "Bean" or the "Responsible Parties"). It also reflects consideration of the public input received by the Trustees in response to publication of their draft DARP in 2004. Additionally, this document describes potential adverse environmental impacts as well as cumulative impacts that may result from the restoration alternatives. It serves, in part, as the Trustee agencies' compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). Additional environmental compliance may be required prior to actual implementation of some of the restoration projects. At this time, the Trustees are seeking written comments from the public on the restoration alternatives described herein.

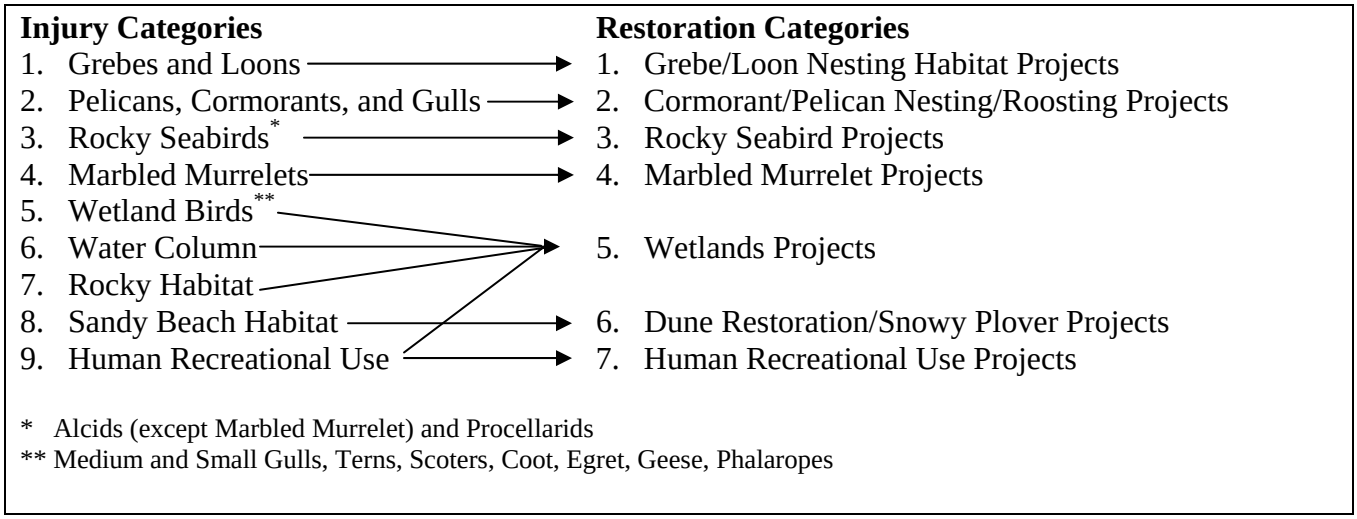
What was injured?

Studies conducted by the Trustees and other experts identified the following injuries to natural resources and recreational services from the spill:

- Marbled Murrelets—135 estimated dead
- Common Murres—1,600 estimated dead
- Other birds—670 estimated dead
- Fish and shrimp— 3,282 kg of shrimp and over 6,000 epipelagic fish estimated dead
- Sandy beach habitat—3,054 acres of shoreline lightly, moderately, or heavily oiled
- Rocky intertidal habitat—162 acres of shoreline lightly, moderately, or heavily oiled
- Recreational services—estimated 9,415 lost user-days, 197 diminished user-days

What restoration projects will compensate for these injuries?

The Trustees grouped the injuries into categories and identified restoration projects that would address each injury category. The figure below provides a conceptual guide to the injury categories and the restoration categories that would address each injury.



After evaluating a number of restoration project proposals, the Trustees identified the following preferred restoration projects.

Protection of Western/Clark's Grebe Nesting Colonies at Northern California Lakes
This project would fund some of the recommendations from a recent study of the status and management needs of Western and Clark's Grebes at their breeding grounds in California (Ivey 2004). These recommendations are designed to protect Western and Clark's Grebe nesting colonies from human disturbance. These recommendations include public education and outreach, as well as the establishment of small seasonal buffers around grebe nesting colonies.

Brown Pelican Roost Site Protection
This project will provide protection to brown pelican roost sites from human disturbance. In the Humboldt area, pelicans are most common in the fall and have limited roosting sites available at high tide. This project will be flexible and respond to disturbance issues as they arise or are anticipated. Potential project elements include public outreach and education through signs and educational materials; protective fencing, signs and/or buoys; and monitoring and adaptive management.

Restoration of Common Murre nesting colony
Contribute toward the restoration of an extirpated murre colony on Reading Rock, off Humboldt County. This colony once contained over 1,000 Common Murre pairs, but has declined to near zero as a result of human disturbance and possibly oil spills, including the *Stuyvesant* spill. This project would combine public education to reduce disturbance with social attraction techniques that have proved successful in re-attracting murres to former nesting sites.

Protection of Marbled Murrelet nesting habitat
This project would protect good occupied nesting habitat from logging and other development pressures and manage it for Marbled Murrelets. Good nesting habitat is defined as residual or old growth redwood forest with characteristics conducive to murrelet nesting. "Occupied" implies that murrelets currently nest there. This project will protect such stands that are currently at risk of logging and/or other human disturbance and manage them for Marbled Murrelets. The Trustees' preferred restoration project is the protection and management, through a conservation easement, of an old growth redwood parcel owned by Green Diamond Resource Company in Humboldt County. The easement will be held in perpetuity by a non-profit entity and managed on behalf of the Trustees for the protection and enhancement of Marbled Murrelet habitat. The Trustees will have a right to enforce the terms of the conservation easement.

Protection of Marbled Murrelet nesting success through corvid management
Improve Marbled Murrelet nest success by contributing to on-going corvid (*i.e.*, ravens, jays, crows) management projects in Redwood National Park and vicinity. Corvid populations are artificially high in areas where human food waste is readily accessible. This, in turn, leads to increased predation of Murrelet nests by corvids. Management efforts may include education of park campers and visitors regarding control of food waste, improved garbage facilities, and outreach to nearby communities where food waste may support artificially high corvid numbers.

Restoration of salt marsh wetlands
Contribute toward the McDaniel Slough Marsh Enhancement Project. This project primarily consists of removing the tide gates at McDaniel Slough, constructing new levees around the project perimeter, and breaching the bay-front levee. The full project is anticipated to restore approximately 200 acres of tidal wetlands and 20-27 acres of marsh plain, along with providing new hiking trails and educational opportunities for the public.

Restoration of coastal dune habitat
Implement non-native plant control efforts in selected dune systems in Humboldt County to encourage recovery of native dune plant species, and develop human disturbance reduction controls to protect nesting Snowy Plovers.

Enhancement of recreational amenities
Implement human access improvements, develop educational aids and conduct a tide pool baseline study at Palmer's Point in Patrick's Point State Park, and contribute to the McDaniel Slough Marsh Enhancement Project (described above).

Table of Contents

1.0 Introduction and Purpose

This final Damage Assessment and Restoration Plan/Environmental Assessment (DARP) was prepared by State and Federal natural resource trustees (the "Trustees") responsible for restoring natural resources[1] and resource services[2] injured by the September 6, 1999 oil spill from the *Stuyvesant* off the coast of Humboldt County, California (the "Spill"). Consistent with OPA and the National Environmental Policy Act (NEPA), the purpose of restoration planning is to identify and evaluate restoration alternatives and to provide the public with an opportunity for review and comment on the proposed restoration alternatives. Restoration planning provides the link between injury and restoration. The purpose of restoration, as outlined in this DARP, is to make the environment and the public whole for injuries resulting from the Spill by implementing restoration actions that return injured natural resources and services to baseline conditions and compensate for interim losses.

The USFWS, the CDFG, and the California State Lands Commission, are the Trustees for the natural resources injured by the spill (Trustees). As a designated Trustee, each agency is authorized to act on behalf of the public under state and/or federal law to assess and recover natural resource damages and to plan and implement actions to restore, rehabilitate, replace, or acquire the equivalent of the affected natural resources injured as a result of a discharge of oil.

At the time of the Spill, the *Stuyvesant* was owned by Bean Stuyvesant, LLC and operated by Bean Dredging, LLC ("Bean"). Both are Responsible Parties (RPs) under OPA and the California Act. Under OPA and the California Act, the RP is liable for the costs of conducting a natural resource damage assessment, as well as the costs of implementing restoration projects to restore the injured resources.

The Trustees have prepared this final DARP to further inform the public about the natural resource damage assessment and restoration planning efforts that have been conducted following the Spill and to describe the mix of projects they believe will best address the injuries from the Spill. Public comments received on the draft DARP (May 2004) and the Trustees' responses to these comments are contained herein. With regard to this final DARP, the Trustees will consider written comments received during the public comment period before commencing with restoration project implementation. Since the preparation of the draft DARP, the Trustees have settled their natural resource damages claim with the RPs. Pursuant to the settlement, the RPs will purchase a conservation easement, as described herein, and pay money damages to the Trustees to be used to pay for restoration of the injured resources. In preparing this final DARP, the Trustees evaluated whether these settlement terms were sufficient to implement the preferred projects described herein and/or whether any of the tentative preferred projects described in the draft DARP had become infeasible. The Trustees also considered the public comments received on the draft DARP. Any modifications to this final DARP, e.g., based on additional public

[1] Natural resources are defined under the Oil Pollution Act (OPA) as "land, fish, wildlife, biota, air, water, groundwater, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any State or local government or Indian tribe, or any foreign government.

[2] Services (or natural resources services) means the functions performed by a natural resource for the benefit of another natural resource and/or the public.

comments or a determination that a preferred project has become infeasible or requires modification, will be documented in the Administrative Record.

1.1 Overview of the Incident

On September 6, 1999, the *Stuyvesant* spilled at least 2100 gallons of Intermediate Fuel Oil 180 (IFO-180) into the Pacific Ocean near the mouth of Humboldt Bay, near Eureka, California (Figure 1-1). The incident began at approximately 5:00 pm at least one nautical mile offshore from the channel into Humboldt Bay. A dredge arm on the *Stuyvesant* punctured one of its fuel tanks. At that time, however, the puncture was below the water line and pressure from the ocean water may have limited the release of oil. The dredge proceeded to a point approximately four miles off the North Spit where it dumped its dredge spoils. At this time, 6:54 pm, the vessel became much lighter, the puncture in the fuel tank rose above the water line, and the oil leak may have begun in earnest. The vessel proceeded to return to Humboldt Bay and was inside the channel between the North and South Spits at approximately 7:30 pm. An out-going tide prevented oil from entering Humboldt Bay.

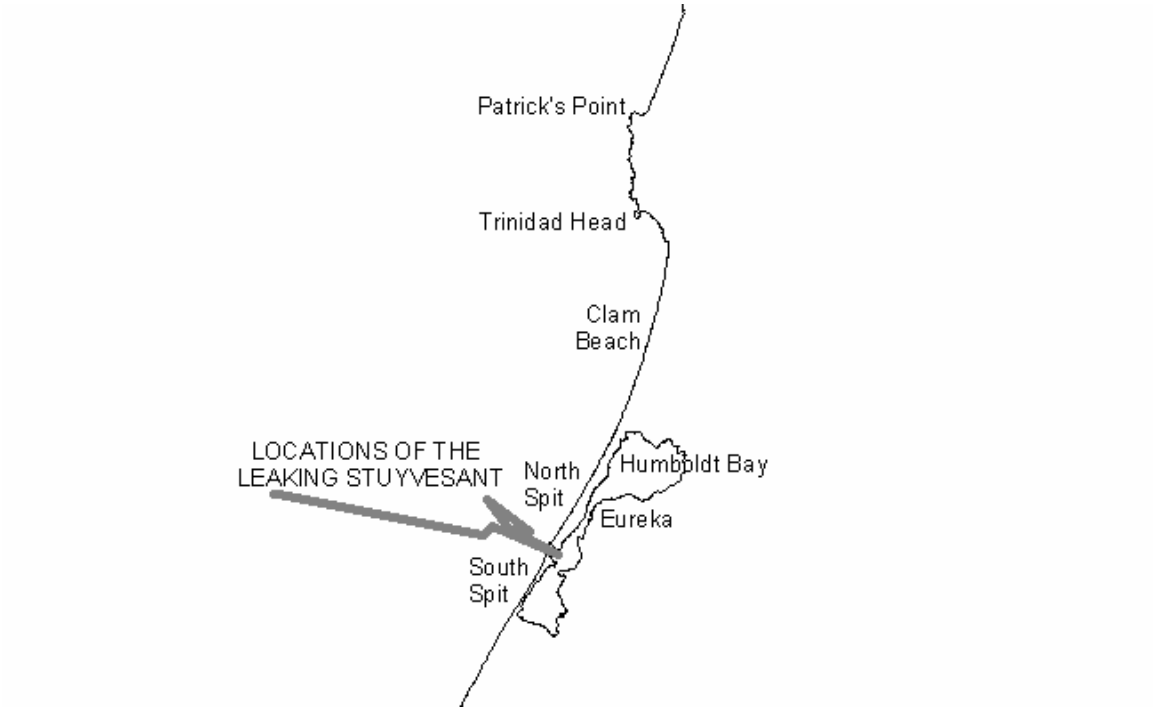
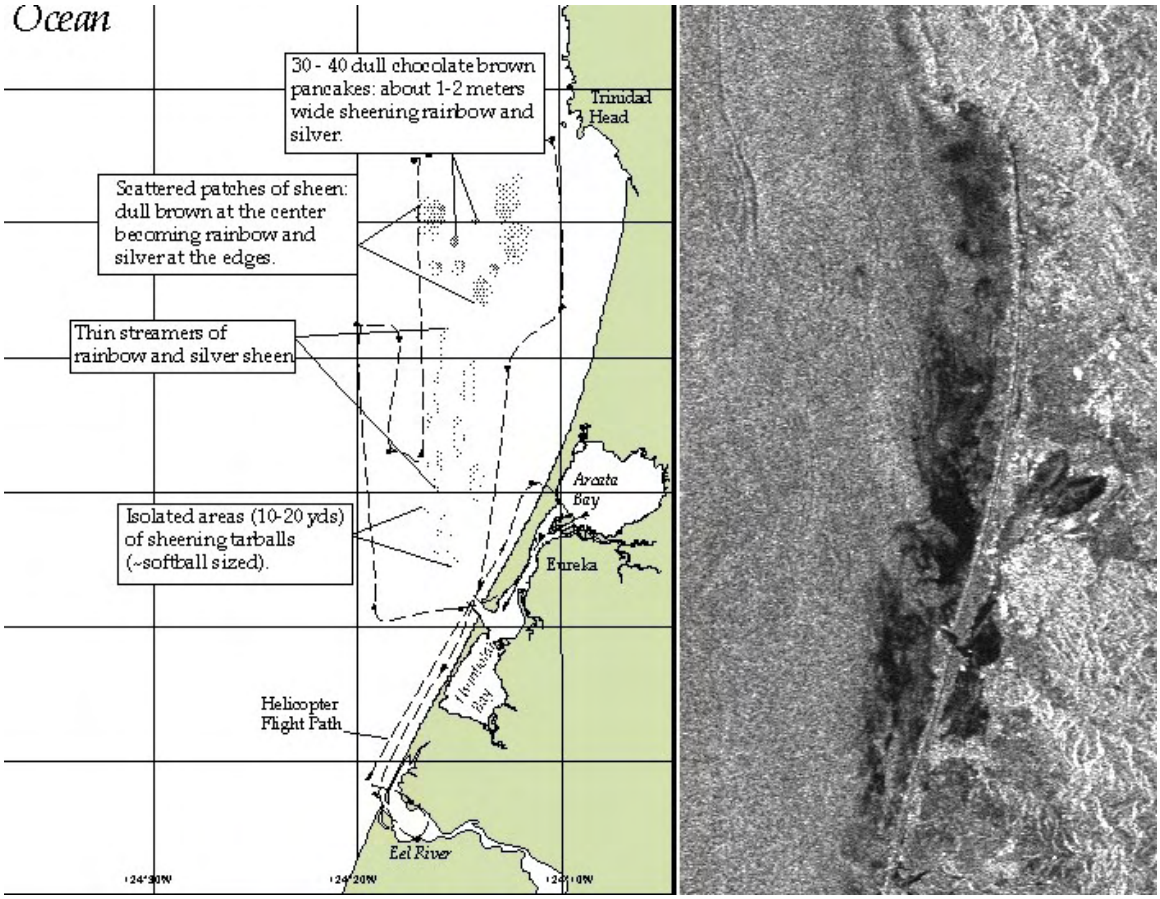


Figure 1-1: Location of the oil spill

At this point, the vessel turned around and headed back out to sea. By 8:22 pm, the *Stuyvesant* was approximately three miles offshore, directly out from the channel entrance. At this time, oil was moved to other compartments in the vessel in an effort to stem the leak. At 11:30 pm, the vessel moved further offshore. By 4:10 am on September 7, the *Stuyvesant* was approximately 15 miles offshore and the leak was stopped. It appeared that most of the escaped oil was released within four miles of the coastline.

Strong north winds (17 knots at the Eel River Buoy) initially spread oil to the south. However, these were replaced with south winds (15 knots) by the afternoon of September 7. Strong south

winds prevailed for most of the ensuing days, causing the oil to spread primarily to the north. Overflights by National Oceanic and Atmospheric Administration (NOAA) identified oil slicks and tarballs in the ocean as far as 15 miles offshore and as far north as Patrick's Point. Figure 1-2 presents a composite, showing the annotated map from the NOAA overflight that occurred on September 8 between 12:00 noon and 1:30 pm and a Synthetic Aperture Radar (SAR) image taken from the RADARSAT satellite on September 8 at 6:31 am. Analysis of the satellite image confirmed that much of the dark area along the coast was the result of oil on the water.[3] On September 8, shoreline assessment crews observed oil on the shore of the South Spit. On September 9, oil was observed washing ashore between the North Spit and Trinidad Head. Clam Beach was closed to public access from September 9 through 12. Indian Beach, north of Clam Beach, remained closed through September 16.



Sept. 8, noon to 1:30 pm Sept. 8, 6:31 am

Figure 1-2: Overflight map and satellite image of oil spill.

[3] Except in very light and very strong winds, oil can be detected on the water in SAR images because oil flattens the small ripples of water on the ocean's surface. As a result, the oil surface returns a different signal, which appears darker in the image. Note that this is not a visual image, but a reflection of radar waves upon the surface of the earth and water. This method for oil detection may be used at night and in cloudy conditions.

The United States Coast Guard (USCG), the CDFG's Office of Spill Prevention and Response along with other State, Federal and local agencies, established a unified command in responding to the spill. As part of the response activities, wildlife response teams collected 1,251 injured or dead birds, most of them oiled, along the shoreline or at sea between September 7 and 25. Shoreline Cleanup and Assessment Teams (SCAT) conducted surveys daily through September 15.

1.2 Natural Resource Damage Assessment

The Trustees commenced the Pre-assessment Phase of the natural resource damage assessment (NRDA) in accordance with the OPA NRDA regulations (the "OPA regulations") (15 C.F.R. § 990.40), to determine if they had jurisdiction to pursue restoration under OPA and, if so, whether it was appropriate to do so.

Based on their analyses of initial data collected during the response and the Pre-assessment Phase, the Trustees found that they had jurisdiction to pursue restoration under the OPA. The Trustees further determined that response actions had not adequately addressed the injuries resulting from the incident, and that feasible primary and/or compensatory restoration actions existed to address the potential injuries. These determinations were memorialized in a Notice of Intent to Conduct Restoration Planning (Federal Register Vol. 68, No. 226, pages 65944-65946, November 24, 2003).

Consequently, the Trustees initiated the Restoration Planning Phase of the NRDA, in accordance with 15 C.F.R. section 990.50, which includes evaluating and quantifying potential injuries (injury assessment) and using that information to determine the need for and scale (or size) of restoration actions (restoration selection). Bean entered into a cooperative NRDA agreement with the Trustees and was an active and cooperative participant in many of these efforts.

1.3 Summary of Natural Resource Injuries

The Trustees have dedicated considerable time and effort to assessing the nature and extent of natural resource injuries and lost services resulting from this spill. The Trustees have used available information, focused studies, and expert scientific judgments to arrive at the best estimate of the injuries caused by the spill. Principal investigators included State and federal scientists, consultants with damage assessment experience, and local experts. There is, however, some uncertainty inherent in the assessment of impacts from oil spills. While collecting more information may increase the precision of the estimate of the impacts, the Trustees believe that the type and scale of restoration actions would not substantially change as a result of more research. The Trustees have sought to balance the desire for more information with the reality that further research would delay the implementation of the restoration projects, at the expense of the local environment, the citizens of California, and others who use and enjoy the area's natural resources.

Based on the assessment activities, the Trustees believe that the spill caused injuries to natural resources at sea and along the Humboldt County coast, including birds, fish and habitat. The spill also impacted recreational use. It is the intent of the Trustees to address all injuries. However, rather than develop separate restoration projects for each species and habitat type impacted, the Trustees have grouped the injuries into categories, sometimes combining impacts

to similar species or habitats. In this way, one larger restoration project, benefiting a suite of species or one primary species or habitat type, addresses all injuries within that category. The Trustees' injury quantification results are discussed below.

1.4 Summary of Preferred Restoration Projects

The Trustees' mandate under the OPA (see, 33 U.S.C. 2706(b)) is to attempt to make the environment and the public whole for injuries to natural resources and natural resource services resulting from the discharge of oil. This purpose must be achieved through the restoration, rehabilitation, replacement or acquisition of equivalent natural resources and/or services. Thus, for a project to be considered, there must be a connection between natural resource injuries and proposed restoration actions.

Restoration actions under OPA are termed primary or compensatory. Primary restoration is any action taken to accelerate the return of injured natural resources and services to their baseline condition. Trustees may elect to rely on natural recovery rather than primary restoration actions where feasible or cost-effective primary restoration actions are not available, or where the injured resources will recover relatively quickly without human intervention.

Compensatory restoration is any action taken to compensate for interim losses of natural resources and services pending recovery. The scale of the required compensatory restoration will depend on the extent and severity of the initial resource injury and how quickly each resource and associated service returns to baseline. Primary restoration actions that speed resource recovery will reduce the amount of compensatory restoration.

For all of the biological injury categories, the Trustees assumed that natural processes would eventually lead to full recovery of the injured resources. Thus, the Trustees focused on restoration projects that would provide compensatory restoration for interim losses. To the extent that restoration projects are implemented prior to the completion of natural recovery, there is an element of primary restoration. This factor is taken into account in the scaling of the restoration project sizes.

The Trustees and their scientific advisors considered approximately 50 restoration concepts and alternatives with the potential to provide compensatory restoration. These were evaluated based on selection criteria developed by the Trustees consistent with the guidelines provided in the OPA regulations (15 C.F.R. § 990.54(a)). Section 4.2.4 of this Plan presents OPA-based selection criteria developed by the Trustees for this spill. Based on the Trustees' evaluation, a total of eight projects have been selected as the preferred restoration projects (see table below). Note that these preferred restoration projects were identified in part because they were amenable to the scaling process (*i.e.*, the projects were strong candidates for conducting quantitative comparisons between the benefits of restoration and the losses from the Stuyvesant Spill). The Trustees selected the preferred restoration projects after further evaluation and prioritization of the restoration projects, taking into consideration the available restoration funds recovered under the terms of the settlement of their natural resource damages claim and the public comments received on the draft DARP. Thus, some tentatively preferred projects described in the draft DARP differ from the preferred projects now in the final DARP. These changes are indicated, by injury category, in the table below.

Summary of Injuries and Preferred Restoration Projects

Injury Category	Injury Estimate	Draft DARP Preferred Project	Final DARP Preferred Project
Loons and Grebes	77 estimated dead	10% contribution to Lake Earl project to benefit Western Grebe nesting colony	Protection of grebe nesting colonies on northern California lakes
Pelicans, Cormorants, and Large Gulls	139 estimated dead	Protection or creation of 11 Double-crested Cormorant nests and Brown Pelican roost site at Old Arcata Wharf	Protection of Brown Pelican roost sites through education, potential access restrictions, and potential roost site creation.
Alcids (except Marbled Murrelet) and Procellarids	1,937 estimated dead (1,600 Common Murres)	27% contribution to Reading Rock project to benefit Common Murre nesting colony	29% contribution to Reading Rock project to benefit Common Murre nesting colony
Marbled Murrelets	135 estimated dead	Protection or creation of 12 to 14 highly productive nests; Corvid management program	Protection or creation of 12 to 14 highly productive nests; Corvid management program
Wetland Birds	117 estimated dead	Restoration of 4.8 acres of wetland habitat (Hookton Slough restoration)	Restoration of 5.2 acres of wetland habitat (McDaniel Slough restoration)
Water Column Impacts	4.6 million shrimp and 6,000 fish estimated dead	Restoration of 1.2 acres of wetland habitat (Hookton Slough restoration)	Restoration of 1.3 acres of wetland habitat (McDaniel Slough restoration)
Rocky Intertidal Impacts	162 acres impacted	Restoration of 0.8 acres of wetland habitat (Hookton Slough restoration)	Restoration of 0.8 acres of wetland habitat (McDaniel Slough restoration)
Sandy Beach Impacts	3,054 acres impacted	Restoration of 6.6 acres of dune habitat	Restoration of 7.1 acres of dune habitat
Human Recreational Use Losses	9,415 lost user-days 197 diminished user-days	$270,787 contribution toward Humboldt Bay Trails project and recreational beach use improvements at Palmer's Point.	$270,787 contribution toward recreational beach use improvements at Palmer's Point and McDaniel Slough restoration

Note that there are two projects to address the Marbled Murrelet injury and one combined wetland project to address injuries to wetland birds, water column biota, and rocky intertidal habitat. Also, the size of most projects are greater than in the draft DARP to account for the fact that the duration of injuries were longer than anticipated by the Trustees at the time of the draft DARP (*i.e.*, restoration projects are currently not expected to begin before 2007, whereas in the draft DARP expected start dates were in 2004).

2.0 Affected Environment

This chapter presents a brief description of the physical and biological environment affected by the *Stuyvesant* oil spill, and potentially affected by the preferred projects, as required by NEPA (40 U.S.C. Section 4321, et. seq.). The physical environment includes approximately 364 square miles of ocean, 60 miles of shoreline from Eel River Wildlife Area to Sharpes Point, Humboldt Lagoon State Park, and the mouths of Little River, Mad River, various smaller creeks, and Humboldt Bay. The biological environment includes a wide variety of birds, fish, mammals, shellfish, and other organisms. Several State and federally-recognized threatened or endangered species are also found within the spill zone. One species, the Marbled Murrelet, occurs primarily within the oiled area at sea. To the extent that proposed projects are located within this area, this chapter provides information on the affected environment as required by NEPA (42 U.S.C.

Section 4321, et. seq.). For proposed projects located outside this area, additional information on the affected environment is provided along with the project descriptions in Section 4.3.

2.1 Physical Environment

Humboldt Bay is centered geographically on the west coast of Humboldt County. The coast in the vicinity of the bay consists of low-lying river deltas that end in wide sandy beaches, while farther to the north and south are steep cliffs, ridges, and bluffs.

The outer coast of the Humboldt Bay complex contains approximately 1,600 acres of dune forest, vegetated dunes, and open sand. It is home to the Western Snowy Plover (*Charadrius alexandrinus nivosus*). The North and South Spit areas are recognized as the most complete and least disturbed dune ecosystem on the west coast of the United States.

The Humboldt Bay water complex includes the northern Arcata Bay and the southern Humboldt Bay. It is the fifth largest estuary on the west coast and second largest in California. Because of the relatively limited amount of freshwater input to the bay, it has been described as a large, tidally-driven, coastal lagoon. At one time, the bay and adjacent wetlands covered more than 27,000 acres. However, the conversion of tidal areas to pastureland and other uses has reduced this area to 17,000 acres. Salt marsh habitat around the bay has been reduced even more dramatically, from 7,000 acres to approximately 700 acres.

2.2 Biological Environment

Humboldt Bay includes an extensive system of tidal mudflats and eelgrass beds that provide diverse fish and macro invertebrate communities, as well as highly productive year-round foraging habitats for wading birds and shorebirds. Intertidal wetlands are a critical part of the Humboldt Bay ecosystem to shorebirds, providing much of the primary productivity, nutrients, and invertebrate biomass that support the large numbers of birds that use the bay as a wintering area and migratory staging area. Humboldt Bay is very important as a link in the coastal flyway for waterfowl, shorebirds, and other water associated birds, supporting a total of 250 different species (Monroe et al. 1973). It has recently been declared a Western Hemisphere Shorebird Reserve Network site. Eelgrass thrives in the bay, due to the brackish to saline conditions that occur. Eelgrass meadows provide food, cover, spawning areas, or attachment surfaces for a variety of marine invertebrates, fish, shorebirds, waterfowl, and marine mammals. Eelgrass also stabilizes substrate, controls turbidity, and, to a lesser degree, controls shoreline erosion. (Helvie and Lowe 1985)

Rocky shores mark the coastline as one moves farther to the north and the south of the Bay. These areas support intertidal communities (including, crabs, mussels, and other macro invertebrates), as well as marine mammals. Offshore rocks provide habitat for large colonies of Common Murres and other seabirds**.**

Inland from the Bay are ancient redwood forests that include some of the largest and oldest trees in the world. Large old growth trees also provide nesting habitat for the Marbled Murrelet, a seabird that spends most of its life on the ocean.

2.2.1 Species of Concern

There are several species in the spill area that are of special concern due to their population status. These include the Brown Pelican, Snowy Plover, Marbled Murrelet, and Coho Salmon. The bird species, all of which suffered direct impacts from the spill, are discussed in Chapter 4. Coho Salmon, which would have been at sea at the time of the spill, are not suspected of suffering any impacts from the spill.

Two endangered species of plants (Menzies' Wallflower and Beach Layia) occur in dune areas in the Humboldt Bay Area. These plant species were of concern during beach cleanup efforts. Careful management of vehicles and personnel involved in the spill response prevented impacts to these sensitive dune plants.

3.0 Coordination and Compliance

3.1 Authorities and Legal Requirements

The USFWS, the CDFG, and the California State Lands Commission, are the Trustees for the natural resources injured by the spill (Trustees). The USFWS is a designated Trustee for natural resources pursuant to subpart G of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 C.F.R. § 300.600 et seq.) and Executive Order 12580 (3 C.F.R., 1987 Comp. p. 193, 52 Fed. Reg. 2923 (January 23, 1987) as amended by Executive Order 12777 (56 Fed. Reg. 54757 (October 19, 1991)). CDFG has been designated as a state trustee for natural resources pursuant to Section 1006 (b) (3) of the Oil Pollution Act and subpart G of the NCP. Additionally, CDFG has state natural resource trustee authority pursuant to Fish and Game Code §§ 711.7 and 1802 and the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (Government Code § 8670.1 *et seq*.). The CSLC has State natural resource trustee authority pursuant to Public Resources Code sections 6201, et seq. As a designated Trustee, each agency is authorized to act on behalf of the public under state and/or federal law to assess and recover natural resource damages and to plan and implement actions to restore, rehabilitate, replace, or acquire the equivalent of the affected natural resources injured as a result of a discharge of oil. The USFWS is designated as the lead federal Trustee for purposes of coordination and compliance with OPA and NEPA.

3.1.1 Overview of the Oil Pollution Act

The Oil Pollution Act (33 U.S.C. § 2706(b)) establishes a liability regime for oil spills which injure or are likely to injure natural resources and/or the services that those resources provide to the ecosystem or humans. Federal and state agencies and Indian tribes act as Trustees on behalf of the public to assess the injuries, plan restoration to compensate for those injuries and implement restoration. This DARP has been prepared jointly by CDFG, USFWS, and CSLC. As described above, each of these agencies is a designated natural resource Trustee for natural resources injured by the Spill. OPA defines "natural resources" to include land, fish, wildlife, water, water sources and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any State or local government or Indian tribe, or any foreign government. Assessments are intended to provide the basis for restoring, replacing, rehabilitating, and acquiring the equivalent of injured natural resources and

services. OPA authorizes the Trustees to assess damages for natural resources injured under their trusteeship. OPA further instructs the Trustees to develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent of the natural resources under their trusteeship. The process emphasizes both public involvement and participation by the Responsible Party(ies). The regulations for natural resource damage assessments under OPA are found at 15 C.F.R. Part 990.

3.1.1.1 Coordination among the Trustees

Federal regulations implementing OPA provide that where an oil spill affects the interests of multiple trustees, they should act jointly to ensure that full restoration is achieved without double recovery. (15 C.F.R. § 990.14(a)) The Trustees in this matter have worked together from the day of the spill in a shared effort to fully restore the resources that were injured. The National Oceanic and Atmospheric Administration (NOAA) and the California Department of Parks and Recreation (CDPR) initially participated in the NRDA process. Thereafter, NOAA and CDPR decided to withdraw from the process and defer to the remaining Trustees' determinations regarding natural resource injuries and restoration.

3.1.1.2 Coordination with the Responsible Parties

Federal regulations implementing OPA encourage the Trustees to invite responsible parties to participate in the NRDA and enter into agreements with them to promote cost-effectiveness and cooperation. (15 C.F.R, § 990.14(c)) The Trustees extended such an invitation and entered into a Cooperative Natural Resource Damage Assessment Agreement (hereinafter "Agreement") with Bean for this Oil Spill. The Agreement established a process by which representatives of Bean and the Trustees would coordinate their studies and other technical activities in the injury determination and quantification stages of the assessment. The Agreement was subsequently amended to extend its terms to restoration scaling and planning activities.

Under the Agreement, biologists, toxicologists, resource economists, and other specialists representing Bean and the Trustees cooperated as a technical working group in gathering and analyzing data and other information regarding injuries to various species and habitats, and in discussing potential actions that would restore, or compensate for, injured species and habitats. Consultants were employed to assist with certain issues requiring specialized expertise not possessed by representatives of Bean or the Trustees.

The Administrative Record contains the results of this cooperative effort, including reports on specific topics. The determinations and other decisions made by the Trustees, documented in this DARP, reflect consideration of the efforts and input of the technical representatives of the parties.

3.1.1.3 Coordination with the Public

The Trustees invite the public to review and comment on this final DARP. This comment period opens on June 11, 2007 and closes on July 11, 2007. Comments must be received by that date to be considered part of the official record. Comments should be sent to the attention of Carolyn Marn by fax (916-414-6713), in writing (2800 Cottage Way, Rm. W-2605, Sacramento, CA 95825), or via e-mail (Carolyn_Marn@fws.gov).

Further information on activities of the Trustees pertaining to this oil spill will be distributed to those on the Trustees' mailing list, and will be announced at the website http://www.dfg.ca.gov/ospr/ organizational/scientific/nrda/NRDAstuy.htm and through press releases. To be placed on the mailing list please contact Carolyn Marn via the contact information listed above.

3.1.1.4 Administrative Record

The Trustees have opened an Administrative Record (Record) in compliance with 15 Code of Federal Regulations, section 990.45. The Record includes documents relied upon or considered thus far by the Trustees during the assessment and restoration planning performed in connection with the Spill. The Record is on file at the U.S. Fish and Wildlife Service, 2800 Cottage Way, Suite 2605, Sacramento, CA 95825, and the California Department of Fish and Game, 619 Second Street, Eureka, CA 95501. Arrangements may be made to review the Record by contacting Carolyn Marn at 916-414-6602 (for Sacramento) or Kris Wiese at Kwiese@ospr.dfg.ca.gov or 707-441-5762 (for Eureka). The Record Index may also be viewed at http://www.dfg.ca.gov/ospr/organizational/scientific/nrda/NRDAstuy.htm.

3.1.2 Compliance with Applicable Laws and Regulations

3.1.2.1 Federal Statutes

Oil Pollution Act of 1990 (33 U.S.C. §§ 2701, et seq.; 15 C.F.R. Part 990)

The Oil Pollution Act, 33 U.S.C. 2706(b), establishes a liability regime for oil spills which injure or are likely to injure natural resources and/or the services that those resources provide to the ecosystem or humans. Pursuant to OPA, federal and state agencies and Indian tribes act as Trustees on behalf of the public to assess the injuries, scale restoration to compensate for those injuries and implement restoration. This final DARP has been prepared jointly by CDFG, USFWS, and CSLC. As described above, each of these agencies is a designated natural resource Trustee under OPA and/or State law, for natural resources injured by the Stuyvesant Spill. OPA defines "natural resources" to include land, fish, wildlife, water, water sources and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any State or local government or Indian tribe, or any foreign government. Assessments are intended to provide the basis for restoring, replacing, rehabilitating, and acquiring the equivalent of injured natural resources and services. OPA authorizes the Trustees to assess damages for injured natural resources under their trusteeship. OPA further instructs the designated Trustees to develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent of the natural resources under their trusteeship. The process emphasizes both public involvement and participation by the Responsible Party(ies). The regulations for natural resource damage assessments under OPA are found at 15 C.F.R. Part 990.

National Environmental Policy Act (42 U.S.C. §§ 4321, et seq.; 40 C.F.R. Parts 1500-1508)

The National Environmental Policy Act sets forth a specific process of environmental impact analysis and public review. NEPA is the basic national charter for the protection of the

environment. Its purposes are to "encourage productive and enjoyable harmony between man and the environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; and to enrich the understanding of the ecological systems and natural resources important to the Nation." (42 U.S.C. § 4321) NEPA provides a mandate and a framework for federal agencies to consider all reasonably foreseeable environmental effects of their proposed actions and to involve and inform the public in the decision-making process. NEPA also established the Council on Environmental Quality (CEQ) in the Executive Office of the President to formulate and recommend national policies which ensure that the programs of the federal government promote improvement of the quality of the environment.

Generally, when it is uncertain whether an action will have a significant effect, federal agencies will begin the NEPA planning process by preparing an environmental assessment (EA). The EA may undergo a public review and comment period. Federal agencies may then review the comments and make a determination. Depending on whether the effects of a proposed project are considered significant, an environmental impact statement (EIS) or a finding of no significant impact (FONSI) will be issued.

In accordance with the regulations implementing the OPA NRDA process, the Trustees have integrated OPA restoration planning with the NEPA process (15 CFR § 990.23). Accordingly, the draft DARP was integrated with a NEPA EA document. This integrated process allowed the Trustees to meet the public involvement requirement of OPA and NEPA concurrently. The Trustees believe that this process has fully met NEPA requirements for most of the proposed restoration projects described herein. However, additional NEPA analysis may be required or is being conducted prior to implementation of some of the preferred restoration actions described herein that are being planned or are conceptual at this stage (e.g., McDaniel Slough, Pelican Roost Site Protection, Reading Rock).

The Clean Water Act (33 U.S.C. §§ 1251, et seq.)

The federal Water Pollution Control Act (commonly referred to as the Clean Water Act, CWA, or the Act) is the principal federal statute governing water quality. The Act's goal is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The CWA regulates both the direct (point source) and indirect (non-point source) discharge of pollutants into the Nation's waters. Section 402 of the Act established the National Pollution Discharge Elimination System (NPDES) program. The Act allows EPA to authorize state governments to implement the NPDES program. Section 301 of the Act prohibits the discharge into navigable waters of any pollutant by any person from a point source unless it is in compliance with a National Pollution Discharge Elimination System (NPDES) permit.

Section 311 of the CWA regulates, *inter alia*, the discharge of oil and other hazardous substances into navigable waters, adjoining shorelines, and waters of the contiguous zone. The Act allows the federal government to remove the substance and assess the removal costs against the responsible party. The CWA defines removal costs to include costs for the restoration or replacement of natural resources damaged or destroyed as a result of a discharge of oil or a hazardous substance.

Section 404 of the Act authorizes the U.S. Army Corps of Engineers (the Corps) to issue permits, after notice and opportunity for public hearings, for the discharge of dredged or fill material into the waters of the United States. Generally, projects which move material in or out of waters or wetlands require section 404 permits. Section 401 of the Act provides that any applicant for a federal permit or license to conduct any activity which may result in any discharge into navigable waters must obtain certification of compliance with state water quality standards.

The Trustees anticipate that the McDaniel Slough restoration project is subject to CWA permitting requirements. They do not anticipate that any of the remaining preferred restoration actions described herein will trigger CWA permitting requirements. However, the implementing entity for each project will be required to apply for any necessary permits prior to project implementation, including any required CWA permit.

Coastal Zone Management Act (16 U.S.C. §§ 1451, et seq.)

The goal of the Coastal Zone Management Act (CZMA) is to encourage and assist states to preserve, protect, develop and, where possible, restore and enhance valuable natural coastal resources. Participation by states is voluntary. California developed the California Coastal Management Program pursuant to the requirements of the federal CZMA. The California Coastal Act of 1976 made permanent the California Coastal Management Program. The enforceable policies of the CZMA are found in Chapter 3 of the California Coastal Act. NOAA approved the California Coastal Management Program in 1977.

Section 1456 of the CZMA requires that any federal action inside or outside of the coastal zone that affects any land or water use or natural resources of the coastal zone shall be consistent to the maximum extent practicable with the enforceable policies of approved state management programs. It states that no federal license or permit may be granted without giving the State the opportunity to concur that the project is consistent with the state's coastal policies. The regulations implementing the CZMA outline the consistency procedures. (15 C.F.R. Part 930) For the entire California coast, except San Francisco Bay, the California Coastal Commission (CCC) has federal consistency review authority under the CZMA (in the San Francisco Bay area, the San Francisco Bay Conservation and Development Commission has federal consistency review authority under the CZMA).

The Trustees believe that all of the preferred restoration projects described herein can be implemented in a manner that will either have no effect on the coastal zone resources or uses or they are consistent to the maximum extent practicable with the CZMA and the California Coastal Management Program. The USFWS, has determined that at least 6 of the selected projects will have no effect, or only a positive effect, on coastal zone resources and/or uses. The CCC reviewed the USFWS's determination and concurred. The two remaining selected projects are or will be evaluated under the CZMA on a project specific basis. Specifically, McDaniel Slough is being undertaken pursuant to a coastal development permit issued by the CCC to the City of Arcata. The Palmer Point project will require further design and details to make such a determination. However, it will likely be implemented by the State and subject to a coastal development permit. If it is determined that these two selected projects require a federal consistency determination, a federal agency will seek California Coastal Commission concurrence.

Endangered Species Act (16 U.S.C. §§ 1531, et seq.)

The purpose of the Endangered Species Act (ESA) is to conserve endangered and threatened species and the ecosystems upon which they depend. The ESA directs all federal agencies to utilize their authorities to further these purposes. Pursuant to Section 7 of the ESA, federal agencies shall, in consultation with the Secretary of the Department of the Interior and/or Commerce, ensure that any action that they authorize, fund or carry out is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of designated critical habitat.

Under the ESA, the NOAA Fisheries Service (formerly the National Marine Fisheries Service, or NMFS) and the USFWS publish lists of endangered and threatened species. Before initiating an action, the federal action agency, or its non-federal permit applicant, must ask the USFWS and/or NOAA Fisheries Service to provide a list of threatened, endangered, proposed and candidate species and designated critical habitat that may be present in the project area. If no species or critical habitats are known to occur in the action area[4], the federal action agency has no further ESA obligations under Section 7. If the federal action agency determines that a project may affect a listed species or designated critical habitat, consultation is required.

If the federal action agency concludes that the project will not adversely affect listed species or designated critical habitat, the agency submits a "not likely to adversely affect" determination to the USFWS and/or NOAA Fisheries Service. If the USFWS and/or NOAA Fisheries Service concur with the federal action agency determination of not likely to adversely affect, then the consultation (informal to this point) is concluded and the decision is put in writing.

If the federal action agency determines that the project is likely to adversely affect either a listed species or its critical habitat, then more formal consultation procedures are required. See Appendix A for a list of federally listed/proposed species in Humboldt County, CA. There is a designated period of time in which to consult (90 days), and beyond that, another set period of time for the USFWS and/or NOAA Fisheries Service to prepare a biological opinion (45 days). The determination of whether or not the proposed action would be likely to jeopardize the species or adversely modify its critical habitat is contained in the biological opinion. If a jeopardy or adverse modification determination is made, the biological opinion must identify any reasonable and prudent alternatives that could allow the project to move forward.

Several federally-listed species occur in the affected area for this Restoration Plan. The federally endangered California Brown Pelican and the federally threatened Marbled Murrelet and Western Snowy Plover may utilize and/or nest on beaches, other coastal features, and in forests which may be included in selected areas for implementing restoration projects. These species are the target for the proposed restoration in certain of the preferred projects described herein. Marbled Murrelets nest near and around the proposed corvid control projects sites and nest within the acquisition project sites. Corvid and murrelet surveys will occur in a manner that will not disturb murrelets, and are intended to increase nest success of murrelets. Several species of birds, including the California Brown Pelican and the Western Snowy Plover may utilize beaches

[4] Action Area: All areas that may be affected directly or indirectly by the proposed action and not merely the immediate area involved in the action.

near the proposed recreational use projects, habitat restoration projects, and seabird restoration projects. These projects will be implemented outside of the nesting and rearing season and will not be located within zones of the beaches used for nesting unless the project is specifically designed to be implemented during these seasons as is the plover nest protection project.

The Trustees have evaluated the potential effects of the preferred restoration projects on listed species or designated critical habitat and performed the appropriate level of consultation with the USFWS and/or NMFS pursuant to the requirements of the ESA. Also, as a Trustee, the USFWS has conducted and completed an internal Section 7 consultation on the Restoration Plan. However, if the need for a project-specific consultation is identified on any project, it will be conducted as appropriate. Consultation with NMFS is required for the McDaniel Slough project. This consultation will be completed prior to implementation of the project. The Trustees do not believe any of the preferred restoration projects described herein will adversely affect a listed species or critical habitat as the projects are designed to restore and benefit injured resources including the federally-listed species referred to above.

Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801, et seq.)

The federal Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as amended and reauthorized by the Sustainable Fisheries Act of 1996 establishes a program to promote the protection of essential fish habitat (EFH) in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. After EFH has been described and identified in fishery management plans by the regional fishery management councils, federal agencies are obligated to consult with the Secretary of Commerce with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any EFH.

The Trustees do not believe that any of the preferred restoration projects will have an adverse affect on EFH.

Fish and Wildlife Coordination Act (16 U.S.C. §§ 661, et seq.)

The Fish and Wildlife Coordination Act (FWCA) provides the basic authority for the USFWS involvement in the evaluation of impacts to fish and wildlife from proposed water resource development projects. The FWCA requires that federal agencies consult with the USFWS (and/or NOAA Fisheries as may be appropriate) and state wildlife agencies for activities that affect, control or modify waters of any stream or bodies of water, in order to minimize the adverse impacts of such actions on fish and wildlife resources and habitat. This consultation is generally incorporated into the process of complying with Section 404 of the Clean Water Act, NEPA or other federal permit, license or review requirements.

As to those selected projects involving activities that affect, control or modify water bodies, such as the McDaniel Slough project, the implementing entity will be required to consult with the appropriate wildlife agencies and comply with Section 404 of the Clean Water Act, NEPA and/or other federal permit, license or review requirements as appropriate.

Marine Mammal Protection Act (16 U.S.C. §§ 1361, et seq.)

The Marine Mammal Protection Act (MMPA) prohibits, with certain exceptions, the take of marine mammals by U.S. citizens on the high seas, or by any person in waters or on land subject to the jurisdiction of the U.S., and the importation of marine mammals and marine mammal products into the U.S. The Secretary of Commerce is responsible for the conservation and management of pinnipeds (other than walruses) and cetaceans. The Secretary of Commerce delegated MMPA authority to NMFS. The Secretary of the Interior (through the USFWS) is responsible for walruses, sea and marine otters, polar bears, manatees, and dugongs. Subchapter III, formerly known as Title II, of the MMPA established an independent Marine Mammal Commission (and its Advisory Committee) which provides independent oversight of the marine mammal conservation polices and programs being carried out by federal regulatory agencies. The Commission is charged with developing, reviewing and making recommendations on domestic and international actions and policies of all federal agencies with respect to marine mammal protection and conservation and with carrying out a research program. The MMPA provides for several exceptions to the moratorium on taking and importation of marine mammals and marine mammal products. The Secretary may issue permits for take or importation for purposes of scientific research, public display, photography for educational or commercial purposes, enhancing the survival or recovery of a species or stock, importation of certain polar bear parts taken in sports hunting in Canada, and incidental taking in the course of commercial fishing operations.

The Trustees do not believe that any of the preferred restoration alternatives have the potential to result in the take, injury, or harassment of any species protected under the MMPA.

Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703, et seq.)

The Migratory Bird Treaty Act (MBTA) implements four international treaties involving protection of migratory birds, including all marine birds, and is one of the earliest statutes to provide for avian protection by the federal government. The MBTA generally prohibits actions to "pursue, hunt, take, capture, kill, attempt to take, kill, possess, offer for sale, sell, offer to purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird...or any part, nest, or egg of such bird." Exceptions to these prohibitions are only allowed under regulations or permits issued by USFWS.

Hunting of migratory game birds is regulated annually through a process in which the USFWS sets "framework regulations" and "special regulations" designed to maintain sustainable hunting levels. Framework regulations are the foundation of annual regulations and consist of the outside dates for opening and closing seasons, season length, daily bag and possession limits, and shooting hours. Special regulations consist of framework regulations that are applied on a small scale and consist of split seasons, zones and special seasons, state regulations conform to the federal regulations. All other actions prohibited by the MBTA are only allowed under specific permits issued by the USFWS Regional Bird Permit Offices. These permits include special use permits for collection and rehabilitation or preservation of oiled birds during spill response, which usually provides the primary data for determining extent of injury to marine

birds and the need for restoration. Implementation of the preferred restoration projects in this final DARP will be conducted in full compliance with the MBTA.

National Marine Sanctuaries Act (16 U.S.C. §§ 1431, et seq.)

The National Marine Sanctuaries Act (NMSA) authorizes the Secretary of Commerce (Secretary) to designate and manage areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities as national marine sanctuaries. Day-to-day management of national marine sanctuaries has been delegated by the Secretary to the National Marine Sanctuary Program. The primary objective of the NMSA is to protect marine resources, such as coral reefs, sunken historical vessels or unique habitats.

The NMSA prohibits the destruction, loss of, or injury to any sanctuary resource. The Secretary is required to conduct such enforcement activities as are necessary and reasonable to carry out the Act. The Secretary may issue special use permits which authorize specific activities in a sanctuary to establish conditions of access to and use of any sanctuary resource or to promote public use and understanding of a sanctuary resource. The NMSA also establishes liability for response costs and natural resource damages for injury to sanctuary natural resources.

The Spill did not impact natural resources within a marine sanctuary. The Trustees do not believe that any of the preferred restoration projects have the potential to affect resources within a marine sanctuary.

Park System Resource Protection Act (16 U.S.C. § 19(jj))

The Park System Resource Protections Act (16 U.S.C. 19jj), requires the Secretary of the Interior (Secretary) to assess and monitor injuries to the National Park Service (NPS) resources. A "park system resource" is defined by the PSRPA as "any living or nonliving resource that is located within the boundaries of a unit of the NPS.…". The Act specifically allows the Secretary to recover response costs and damages from the Responsible Party causing the destruction, loss of, or injury to park system resources.

The Trustees do not believe that any of the preferred restoration projects have the potential to negatively affect NPS resources

Rivers and Harbors Act (33 U.S.C. §§ 401, et seq.)

The Rivers and Harbors Act regulates the development and use of the Nation's navigable waterways. Section 10 of the Act prohibits unauthorized obstruction or alteration of navigable waters and vests the U.S. Army Corps of Engineers with authority to regulate discharges of fill and other materials into such waters.
Restoration actions that require Section 404 Clean Water Act permits are likely also to require permits under Section 10 of the Rivers and Harbors Act. However, a single permit usually serves for both. Therefore, the Trustees can ensure compliance with the Rivers and Harbors Act through the same mechanisms.

Executive Order (EO) 11988 – Construction in Flood Plains

The 1977 Executive Order 11988 seeks to avoid, to the extent possible, the long-and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct or indirect support of development in flood plains wherever there is a practicable alternative. Each federal agency is responsible for evaluating the potential effects of any action it may take in a flood plain. Before taking an action, the federal agency should determine whether the proposed action would occur in a flood plain. For any major federal action significantly affecting the quality of the human environment, the evaluation would be included in the agency's environmental impact statement prepared pursuant to NEPA. The agency should consider alternatives to avoid adverse effects and incompatible development in flood plains. If the only practicable alternative requires location in a flood plain, the agency should: (1) design or modify the action to minimize potential harm, and (2) prepare and circulate a notice containing an explanation of why the action is proposed to be located in the flood plain.

None of the preferred restoration projects involve construction in a floodplain.

Executive Order 13112 - Invasive Species

The 1999 Executive Order 13112 applies to all Federal agencies whose actions may affect the status of invasive species. The Order requires such agencies, to the extent practicable and permitted by law, to: (1) identify such actions; and (2) take actions specified in the Order to address the problem consistent with their authorities and budgetary resources; and (3) not authorize, fund, or carry out actions that they believe are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, "pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

The Trustees do not believe that any of the preferred restoration projects have the potential to cause or promote the introduction or spread of invasive species.

Executive Order (EO) 12898 - Environmental Justice

On February 11, 1994, President Clinton issued Executive Order 12898, requiring each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority and low income populations. In the memorandum to heads of departments and agencies that accompanied executive Order 12898, the President specifically recognized the importance of procedures under NEPA for identifying and addressing environmental justice concerns. The memorandum states that "each Federal agency shall analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by [NEPA]." The memorandum particularly emphasizes the importance of NEPA's public participation process, directing that "each Federal agency shall provide opportunities for community input in the NEPA process." Agencies are further directed to "identify potential effects and mitigation measures in consultation with affected communities, and improve the accessibility of meetings, crucial

documents, and notices." The Council on Environmental Quality (CEQ) has oversight of the federal government's compliance with Executive Order 12898 and NEPA.

The Trustees have concluded that there is no low income or ethnic minority community that would be adversely or disproportionately affected by the preferred projects in the final DARP. The Trustees have involved the public by providing notice and seeking public comments on the draft DARP and the draft final DARP, holding a public meeting to present and receive comments on the draft DARP and by providing public access to the Administrative Record.

Information Quality Law (Public Law 106-554, Section 515)

Information disseminated by federal agencies to the public after October 1, 2002, is subject to information quality guidelines developed by each agency pursuant to Section 515 of Public Law 106-554 that are intended to ensure and maximize the quality of the objectivity, utility and integrity of such information. This final DARP is an information product covered by information quality guidelines established by USFWS and DOI for this purpose. The quality of the information contained herein is consistent with these guidelines, as applicable.

3.1.2.2 State Statutes

California Environmental Quality Act (Pub. Res. Code §§ 21000-21178.1)

CEQA was adopted in 1970 and applies to most public agency decisions to carry out, authorize or approve projects that may have adverse environmental impacts. Its basic purposes are to inform California governmental agencies and the public about the potentially significant effects of proposed activities, identify ways that environmental damage can be avoided or significantly reduced, prevent significant avoidable damage to the environment through adoption of feasible alternatives or mitigation measures, and to disclose the reasons for agency approval of a project resulting in significant environmental effects.

The CEQA process begins with a preliminary review as to whether CEQA applies to the project in question. Generally, a project is subject to CEQA if it involves a discretionary action that is carried out, funded or authorized by an agency (*i.e.*, the lead agency), and it has the potential to impact the environment. Once the lead agency determines that the project is subject to CEQA, the lead agency must then determine whether the action is exempt from CEQA compliance under either a statutory or categorical exemption. Examples of categorical exemptions include actions taken by regulatory agencies for protection of natural resources and actions by regulatory agencies for protection of the environment (Title 14 CCR, Chapter 3, §§ 15307-15308).

If the lead agency determines that the project is not exempt, then an Initial Study is generally prepared to determine whether the project may have a potentially significant effect on the environment. Based on the results of the Initial Study, the lead agency determines whether to prepare a Negative Declaration (i.e., the project will not result in significant adverse effects to the environment) or an Environmental Impact Report (EIR). The test for determining whether an environmental impact report (EIR) or negative declaration must be prepared is whether a fair argument can be made based on substantial evidence that the project may have a significant adverse effect on the environment.

CEQA encourages the use of a federal EIS or FONSI prepared pursuant to NEPA when such documents are available, or the preparation of joint state/federal documents, in lieu of preparing a separate EIR or negative declaration under CEQA. Accordingly, this RP/EA and subsequent FONSI, if issued, may be relied upon or adopted by the state Trustee agencies or other state or local agencies towards compliance with the CEQA as required for discretionary projects that are authorized, funded or carried out by California state or local agencies. To this end, the state Trustees have coordinated with the federal Trustees to ensure the RP/EA and FONSI comply with the provisions of CEQA Guidelines including state public review requirements (Title 14 CCR, Chapter 3, § 15220 *et seq*.).

Additional CEQA compliance may be required for some of the projects described herein prior to actual implementation. This will be determined once detailed engineering design work or operational plans are developed for the preferred projects.

California Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (Gov. Code §§ 8670.1, et seq.)

The Lempert-Keene-Seastrand Oil Spill Prevention and Response Act became effective on September 24, 1990. This legislation is the key state compensatory mechanism for subsequent spills and establishes a comprehensive liability scheme for damages resulting from marine oil spills. Recoverable damages include damages for the injury to, destruction of, or loss of natural resources, including the reasonable costs of assessing the injury, destruction, or loss, the cost of rehabilitating wildlife, habitat, and other resources, and the loss of use and enjoyment of natural resources, public beaches, and other public resources. Responsible parties are required to fully mitigate adverse impacts to wildlife, fisheries, and wildlife and fisheries habitat by successfully carrying out environmental restoration projects or funding the activities of CDFG to carry out environmental restoration projects.

California Coastal Act (Pub. Res. Code §§ 30000, et seq.)

The California Coastal Act was enacted by the State Legislature in 1976 to provide long-term protection of California's 1100-mile coastline for the benefit of current and future generations. The Coastal Act created a partnership between the State (acting through the California Coastal Commission) and local government (15 coastal counties and 58 cities) to manage the conservation and development of coastal resources through a comprehensive planning and regulatory program. The Commission reviews and approves Local Coastal Programs, which are the basic planning tools used by local governments to guide development in the Coastal Zone. New development in the Coastal Zone may require a permit from the Commission or the appropriate local government agency.

The Trustees do not believe that the preferred restoration alternatives in this final DARP will adversely affect the state's coastal zone. However, the implementing entity for each project will be required to apply for any necessary permits and approvals, including any required coastal development permit.

California Endangered Species Act (Fish and G. Code §§ 2050 et seq.)

Pursuant to the California Endangered Species Act (CESA), it is the policy of the State of California that state agencies should not approve projects as proposed that would jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat essential to the continued existence of those species if there are reasonable and prudent alternatives available. However, if reasonable alternatives are infeasible, individual projects may be approved if appropriate mitigation and enhancement measures are provided.

Pursuant to the CESA, the Fish and Game Commission has established a list of threatened and endangered species based on criteria recommended by the California Department of Fish and Game. Section 2080 of the California Fish and Game Code prohibits "take" of any species that the Commission determines to be an endangered species or a threatened species. Take is defined in Section 86 of the Fish and Game Code as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." The CESA allows for take incidental to otherwise lawful development projects. The CESA emphasizes early consultation to avoid potential impacts to rare, endangered, or threatened species and to develop appropriate mitigation planning to offset project-caused losses of populations of listed species and their essential habitats.

Two state-listed bird species occur in the area affected by this Restoration Plan. The State endangered Brown Pelican and Marbled Murrelet may utilize waters or lands in areas selected for implementing restoration projects. Additionally, these species are the target for the proposed restoration in certain of the proposed restoration projects. Marbled Murrelets nest near and around the proposed corvid control projects sites and nest within the acquisition project sites. Corvid and Murrelet surveys will occur in a manner that will not disturb Murrelets, and are intended to increase nest success of Murrelets. The California Brown Pelican may utilize beaches near the proposed recreational use projects, habitat restoration projects, and seabird restoration projects.

While the Trustees do not believe the proposed restoration project would result in the take of any state-listed species, the Trustees will evaluate the potential effects of the selected projects on these species and consult with the CDFG as may be appropriate pursuant to the requirements of the CESA.

California Harbor and Navigation Code, section 294

Harbors and Navigation Code Section 294 creates absolute liability for damages from the discharge or leaking of gas, oil, or drilling waste onto marine waters. Damages include cost of wildlife rehabilitation and injury to natural resources or wildlife, and “loss of use and enjoyment of public beaches and other public resources or facilities.”

Public Resources Code, Division 6, sections 6001, et seq.

The Public Resources Code, Division 6, gives the CSLC trustee ownership over State sovereign tide and submerged lands. Permits or leases may be required from the CSLC if a restoration project is located on such lands.

3.1.2.3 Other Potentially Applicable Statutes and Regulations

Additional statutes, regulations, or executive orders may be applicable to NRD restoration activities, including those listed below.

- National Park Act of August 19, 1916 (Organic Act), 16 U.S.C. 1, *et seq*.
- Archaeological Resources Protection Act, 16 U.S.C. 460, *et seq*.
- National Historic Preservation Act of 1966 as amended (16 U.S.C. 470-470t, 110)
- Clean Air Act, 42 U.S.C. 7401, *et seq*.
- Executive Order 11514 – Protection and Enhancement of Environmental Quality
- Executive Order 11990 – Protection of Wetlands
- Executive Order 11991 – Relating to the Protection and Enhancement of Environmental Quality
- Porter-Cologne Water Quality Control Act, Water Code Sections 13000 et seq.

4.0 Injury Quantification and Restoration Planning

This chapter describes the Trustees' efforts to quantify the nature, extent, and severity of injuries to natural resources and the lost or diminished recreational uses resulting from the oil spill (please refer to section 3.1.1.2, above, which describes the cooperative assessment approach utilized by the Trustees). It begins with an overview of the data collected immediately after the spill as part of the "pre-assessment" phase, followed by a description of the damage assessment strategy and methods used to determine and quantify the injuries. The remainder of the chapter presents summaries of the injury quantification results, restoration options, including a no-action alternative, and restoration scaling for all injury categories.

4.1 Overview of Pre-assessment Activities and Findings

When oiled birds began arriving on the beaches, the Trustees responded recognizing the potential for significant natural resource injuries. Pre-assessment activities, as described in the OPA regulations, focused on collecting ephemeral data essential to determine whether: (1) injuries had resulted, or were likely to result, from the incident; (2) response actions were adequately addressing, or were expected to address, the injuries resulting from the incident; and (3) feasible restoration actions existed to address the potential injuries. The following summarizes key Pre-assessment activities and findings:

Oiled Wildlife Search and Collection: These activities were conducted for response purposes to capture live oiled wildlife, if possible (for potential rehabilitation), and to remove dead oiled wildlife from the impacted areas. The data gathered related to these activities is useful for natural resource damage Pre-assessment. In this case, search and collection spanned 20 days (from September 8 to 28 1999) and covered 100 miles of coastline (from the South Spit of the Humboldt Bay to the Smith River). These surveys recovered a total of 1,251 birds (642 live and 609 dead), including 24 Marbled Murrelets. The breakdown by species is provided under the injury categories below. The surveys also documented impacts to the water column, as over 2 million shrimp (*Thyanoessa spinifera*) were discovered washed up dead along the North Spit (*i.e.*, Fairhaven Beach and Dugan's Cove) and along the northern portion of the South Spit.

Shoreline Cleanup and Assessment Team (SCAT) Surveys: These surveys were conducted for response purposes, to inform and guide the Incident Command Center in their efforts to cleanup the oil. The data gathered by these surveys is useful for natural resource damage Pre-assessment. In this case, the surveys spanned 20 days (from September 8 to 28, 1999) and covered 100 miles of coastline (from the South Spit of Humboldt Bay to the Smith River). These surveys indicated that 60 miles of coastline, including both sandy beach and rocky intertidal habitat, were exposed to oil.

Aerial Surveys: These surveys were conducted, to provide counts and species identification of marine birds and mammals in the vicinity of the spill or spill trajectory. The data gathered by these surveys was useful for natural resource damage Pre-assessment. Surveys were conducted on September 8 and 9, 1999. Near shore survey lines were flown parallel to the coast about 50 meters to 100 meters from the edge of the surf zone, and offshore survey lines were flown up to 19 km seaward. On September 8 and 9, the total survey distance flown was 882.13 km. These surveys extended as far north as the mouth of the Klamath River and as far south as the mouth of Humboldt Bay. A third survey was flown on October 1, 1999, in order to provide wildlife data for the coastline north of the Klamath River. This 380.4 km survey covered the area between the mouth of Humboldt Bay and Crescent City, California.

Boat Surveys: These surveys were conducted for response purposes, to provide information on location of oil on water and oiled wildlife, and to census marine birds and mammals that were at risk of exposure to oil. Surveys were conducted in Humboldt Bay (north and south bays, and the shipping channel) and adjacent offshore waters from September 7 to 24, 1999. Offshore survey transects ran parallel to the shore at distances of 400 m, 800 m, 1.4 km, 2 km, 3 km, 5 km, and 10 km offshore.

Human Recreational Use Research: During the spill, the Trustees documented beach closures and maintained communication with local authorities and the Incident Command Center regarding other possible impacts to human recreational activities.

Based on information collected during the Pre-assessment efforts summarized above, the Trustees identified the following categories of injury: (1) birds (which were further divided into sub-groups according to species and restoration options), (2) water column species, (3) shoreline habitat, and (4) recreational use. The Trustees determined that a number of potential restoration actions exist to compensate for the losses and proceeded with injury assessments.

4.2 Injury and Damage Assessment Strategy

The goal of injury assessment is to determine the nature, extent and severity of injuries to natural resources, thus providing the technical basis for evaluating and scaling restoration actions. The OPA regulations define injury as “an observable or measurable adverse change in a natural resource or impairment of a natural resource service.” Diminution in the quantity and/or quality of recreational use of natural resources also constitutes an injury as defined by the OPA regulations.

For each of the injury categories, the Trustees selected appropriate assessment procedures based on the: (1) range of procedures available under section 990.27(b) of the OPA regulations; (2)

time and cost necessary to implement the procedures; (3) potential nature, degree, and spatial and temporal extent of the injury; (4) potential restoration actions for the injury; (5) relevance and adequacy of information generated by the procedures to meet information requirements of planning appropriate restoration actions; and (6) input from consultants with damage assessment experience, scientific experts, and/or technical consultants representing Bean.

Each injury assessment focused on determining both the magnitude of the injury (*i.e.*, number of animals killed or area of habitat lost) and the time to full recovery. This produces an estimate of direct plus interim (from the time of injury until full recovery) loss of resources resulting from the oil. Injury estimates in future years were discounted at three percent per year (NOAA 1999).

4.2.1 Damage Assessment Methods for Birds

4.2.1.1 Estimation of Numbers of Birds Impacted

The first step in injury quantification was to estimate the number of birds impacted, by species. Not all impacted birds are found and collected during spill response for a variety of reasons:

- *Unsearched areas*. Because precipitous parts of the coastline are inaccessible, they often remain unsearched by spill responders. In this case, much of the Trinidad Head area was unsearched or sparsely searched.
- *Scavenging*. Scavengers (including mammals such as raccoons and birds such as gulls and crows) may pick apart or entirely remove dead birds from the beaches.
- *Search efficiency*. Spill responders searching for beach cast birds may not find them all.
- *Re-wash*. Bird carcasses that are deposited on a beach may be subsequently removed from the beaches by high tides or large waves and re-deposited elsewhere. One recent study found that birds on sandy beaches were more subject to re-wash than birds on rocky coastlines (Glenn Ford, R.G Ford Consulting Company, Inc., personal communication). Over time, birds would end up disproportionately on rocky shorelines, where they are less likely to be removed by re-wash processes. This study also found that dead birds were just as likely to strand on "reflective" coastlines, with cliffs and rocks, as they were to strand on sandy "depositional" beaches.
- *Beach transit*. It is often assumed that live oiled birds come to the beaches and simply stop there. Recent experience, however, has noted that many birds, including Common Murres, may continue walking inland, perhaps in search of cover. In one case, 16 of 16 live beached murres walked several hundred meters inland into a dune complex, where they could not be found (Steve Hampton, CDFG, personal communication). This was based on observations of Common Murre tracks heading into adjacent dunes.
- *Removal or burial by the public*. On beaches with even light human use, dead birds are subject to being tossed in trash cans or buried in the sand. This may prevent their discovery by spill response crews.
- *At-sea loss*. Because many oiled hypothermic birds lose bodyweight quickly and die of starvation within two days (Oka and Okuyama 2000), some birds never make it to the beach. Dead or dying birds are often subject to winds and currents, which may carry them offshore. Additionally, dead and dying birds are subject to scavenging and predation while at sea.

- *Departure from the area*. Larger birds, such as pelicans, are sometimes able to survive minor oiling for many days. During this time, they may travel well outside the spill zone and beyond the scope of response personnel.

The Beached Bird Model (see Ford et al. 1987) seeks to take some of these factors into consideration, by estimating the number of birds killed from the numbers of birds found on the beach (a method called "back casting"). Using estimated rates of carcass disappearance, the number of birds removed or not found on the beaches is then estimated. Using a simplified example, if the odds of a bird being removed by a scavenger in the course of a day are 50% and the odds of it being overlooked by a searcher are 50%, then the odds of it being recovered are 25%. This would imply that, for every one bird found, three more are missed. This would result in a "beached bird multiplier" of four. That is, one bird recovered implies that four birds were impacted.

The Beached Bird Model used in this case was based on Ford et al. (1987; 1996), but was further developed by the Trustee-RP technical working group. Modifications to the model also relied on previous studies to guide the choice of scavenging and search efficiency parameters (Ford et al. 2000, 2002). The model incorporated different scavenging rates for large and small birds; it was assumed that small birds were more likely to be removed from the beaches than large birds. The definition of a small bird was one that could be carried off by a gull or raven. Large birds could only be removed from the beach by a mammalian scavenger. The cut-off for small birds was Rhinoceros Auklet. Birds larger than this were considered large birds. In addition, all birds were more likely to be scavenged when fresh, and less likely as they decomposed. Likewise, the model incorporated different search efficiency rates, depending upon the size of the bird, the coloration of its plumage, the method of the search, and the type of beach that was searched. The Trustee-RP technical working group assumed that small, dark, birds on rocky beaches had lower "find ability" than larger, white-bellied birds on open sandy beaches. They also assumed that searches conducted using ATVs or vehicles had lower search efficiency than foot searches.

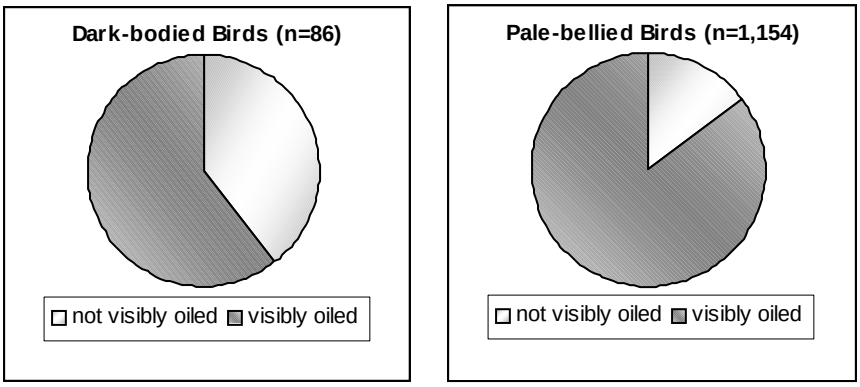
Because of the location of the spill and level of search effort, re-wash, beach transit, removal or burial by the public, at-sea loss, and departure from the area were considered to be small factors in this case and were not evaluated or included in the model. To the extent that these factors contributed to carcass disappearance, the model may provide an underestimate of actual bird mortality.

During any spill response, some level of natural background mortality can be expected to contribute to the number of birds collected. Before the Beached Bird Model can be employed, it is appropriate to separate such birds from the spill-related birds that were collected. It is not sufficient to assume that birds without visible oiling are not spill related. Spill related birds might show no visible oiling for the following reasons:

- *Thin sheen or small amounts of oil*. For ocean-going birds that must rely on the sea for their food, a spot of oil the size of a nickel may be sufficient to cause death. Like a hole in a wetsuit, the oil destroys the feathers' ability to insulate the bird, thus allowing cold ocean water to spread against the bird's skin. Birds typically die of hypothermia and starvation (Moskoff 2000). Often, such small traces of oil may be difficult to see on a bird. They may appear wetted, like a wet dog, but show no oil.
- *Scavenging*. Oil usually coats the under parts of a bird, such as the belly and breast, as the bird swims in the ocean. These are the same parts of the bird that are removed by

scavengers. Experience in California and a recent study in Canada have found that scavengers do not hesitate to feed upon oiled birds (Wiese 2002). When this occurs, those feathers are often removed. Scavenging often occurs in the first few hours or days after a bird is beached. It is not unusual for a fresh bird to be reduced to a skeleton overnight (Ford et al. 2002).

- *Dark plumage*. Because oil is usually black, it is most difficult to see on dark-plumaged birds. While most seabirds have white under parts, some are entirely dark in plumage color. In this spill, dark-plumaged birds (Sooty Shearwater, all cormorant species, all scoter species, Tufted Puffin, and Pigeon Guillemot) were almost three times as likely to be labeled "not visibly oiled" as were pale-bellied species (40% verses 15%).



There are two approaches to accounting for natural mortality among the birds collected:

1. Examine each entry in the intake log and remove each individual bird that seems unlikely to be spill related (*e.g.*, old, desiccated carcass on the first day of the spill; gunshot wound, etc.)
2. Estimate the average background carcass deposition rate and subtract a flat rate from the total number of birds collected during the response. In some cases, beached bird surveys in the area may provide historical data for individual beaches and time of year, by species.

In this case, the Trustee-RP technical working group (see section 3.1.1.2 for a description of this group) agreed to use the first approach. After careful evaluation of the bird intake logs, they agreed that 1,251 birds were spill-related. Nineteen birds were determined to be unrelated to the spill, as their carcass condition indicated that they pre-dated the spill.

Using this data set of 1,251 birds, the Beached Bird Model was employed to estimate the actual mortality that occurred during the spill. Additionally, the Trustees had to evaluate the fate of rehabilitated and released birds. During the response, 284 birds were rehabilitated and released, 253 of which were Common Murres. Although there is uncertainty associated with the fate of such birds, several studies have suggested that post-rehabilitation survival is extremely low (*e.g.*, less than 10%), especially for alcids such as Common Murres (Sharp 1996). During the Stuyvesant response, the Oiled Wildlife Care Network conducted a telemetry study of Common Murres associated with this oil spill. Detailed results have not yet been published, but summaries have been presented at meetings (Newman and Mazet 2001). These summaries suggest a survival rate possibly greater than the earlier studies. Given this, the Trustees assumed that 75% of the rehabilitated birds died (n = 213), while 25% survived to join (or re-join) the

breeding population. The results of the Beached Bird Model are presented in the Injury Quantification section for each species grouping below.

4.2.1.2 Bird Restoration Categories

For restoration planning purposes, the Trustees concluded that it was not desirable to implement restoration projects for each of the 35 bird species impacted. For many of these species, no restoration project has ever been implemented, creating challenges with respect to feasibility. For others, the impact was relatively small, implying that a small restoration project would suffice for compensation. The implementation of many small projects, however, would be economically inefficient, as each project incurs some level of fixed costs. Thus, in order to focus restoration efforts on larger, efficient, and feasible projects, the Trustee RP technical working group created restoration categories for birds according to the following criteria:

1. The species in each group should be similar in their habitat preferences and life histories.
2. The species in each group are likely to benefit from a single restoration action.
3. Each grouping must contain one or more species for which there are feasible restoration options.
4. Species with declining populations with special restoration needs should be specifically addressed to the extent feasible.

The following groupings were constructed by the technical working group:

Marbled Murrelet
This species is unique in that it is the most sensitive species, with respect to population size, to suffer direct mortality from the spill and thus requires special attention in terms of both primary and compensatory restoration. Furthermore, among the species impacted by the spill, this species has relatively narrow habitat requirements.

Grebes and Loons
These species are fairly similar in their breeding and wintering habitat preferences, as well as their foraging techniques and prey preferences.

Large Gulls, Cormorants, Pelicans
These species can all be found on coastal rocks and other platforms, where they nest or roost. They all forage in the near-shore ocean. A project providing nesting or roosting opportunities for any one of these species will likely benefit the others. Large Gulls includes Western and Glaucous-winged Gulls.

Alcids (except Marbled Murrelet), Procellarids
This category includes the Common Murre, the species most heavily impacted, with respect to numbers killed, by the spill. All of these species forage at sea and nest on offshore rocks and islands.

Medium and Small Gulls, Terns, Scoters, Coot, Egret, Geese, Phalaropes
This is a category for several species that suffered relatively less mortality than others, with

the exception of the scoters. Most of these species forage in wetlands or on fish or invertebrates that come from wetlands. The gulls include California, Ring-billed, and Sabine's Gull.

Snowy Plover
While no birds of this species were collected dead, ten were observed oiled. Snowy Plovers are a sensitive species with unique habitat preferences, and the coastal population of the Western Snowy Plover is listed as threatened under the federal Endangered Species Act.

All impacted birds were accounted for in the calculation of compensatory damages. Thus, just because a species was grouped with others and may not benefit from a specific restoration project, it was not ignored in the damage estimations. Spill-related mortality was estimated for each species and all injuries within each grouping were counted when scaling restoration.

4.2.1.3 Damage Quantification for Birds

Damage quantification relied on a service-to-service restoration-based approach; that is, the Trustees sought to determine appropriate restoration projects to both restore the injured resources and compensate for the interim losses between the time of the spill and full recovery to pre-spill conditions (see NOAA 1997). Restoration scaling is the process of determining the appropriate size of a restoration project. These projects, because of their compensatory nature, are intended to provide resources "of the same type and quality, and of comparable value" as the resources which were injured (NOAA 1995). For this task, the Trustees relied upon the Resource Equivalency Analysis (REA) method for injury and restoration scaling.

The REA method is divided into two main tasks: the debit calculation and the credit calculation. The debit calculation involves determining the amount of "natural resource services" that the affected resources would have provided had they not been injured. The unit of measure may be acre-years, stream feet-years, or some other metric (such as bird-years). The credit calculation seeks to estimate the quantity of those resource services that would be created by a proposed compensatory restoration project. Thus, the size of the restoration project is said to be "scaled" to equal the size of the injury. Consistent with federal recommendations for NRDA (NOAA 1997; see also NOAA 1999) and generally accepted practice in the field, future years are discounted at a rate of 3% per year. This discounting is done based on the assumptions that present services are more valuable than future services, and that some uncertainty exists when estimating future restoration benefits. This assumption is typically used by the Trustees when scaling restoration projects.

When the injury is primarily to individual animals rather than to a complete habitat, the REA may focus on lost animal-years. For example, suppose an oil spill causes negligible injury to a body of water, but results in the death of 100 ducks. Using information about the life history of the ducks (*e.g.*, annual survival rate, average life expectancy, average fledging rate, etc.), it is possible to mathematically model/estimate the lost "duck-years" due to the spill. On the credit side, restoration projects can be designed to create duck nesting habitat and scaled, such that the size of the project is sufficient to create as many "duck-years" as were lost in the incident. This is the approach used for the bird species groups listed above. The scaled project sizes and some of the details used in the scaling calculations are provided below. See Appendix B for further details on the REA method.

There are a variety of ways to calculate lost bird-years, all of which imply informed biological assumptions regarding the recovery of the species from the spill. For all species, the Trustees assumed that a representative section from each age class was killed by the spill. For all species except the Marbled Murrelet, the Trustees employed a single-generation stepwise replacement approach, which will be described here. The Marbled Murrelet calculation will be described under the Injury Quantification section for that species below.

The single-generation stepwise replacement approach to calculation of lost bird-years assumes that each year after the spill the juvenile age class will be entirely replaced. That is, despite the fact that some breeding adults have been removed from the population, the population produces the same number of juveniles post-spill as it did pre-spill.[5] Thus, the youngest age class impacted by the spill will fully recover to its pre-spill level after the next breeding season. The second-year age class will fully recover two years after the spill, as the recovered first-year birds grow older. Likewise, the third-year age class will fully recover after three years, and so on. Mathematically, this is equal to calculating the number of years lost by the killed birds, based on the life expectancy of each age class. Details regarding the demographic parameters used to calculate lost bird years are presented in Appendix C.

The bird-years gained by each restoration project were evaluated differently, depending upon the benefits associated with each specific project. These will be explained below.

4.2.2 Damage Assessment Methods for Habitat

The impacted habitats included the water column and shoreline habitats.

For evaluating impacts to the water column, the Trustee-RP technical working group estimated the number of dead animals within the water column, using observations of dead shrimp and modeling of oil toxicity in the ocean. This injury quantification information was then used in a trophic-level REA to scale an out-of-kind restoration project (wetlands) that would compensate for injuries to the water column. This is explained in detail in Section 4.3.6 and Appendix I.

For evaluating impacts to shoreline habitats, the Trustee-RP technical working group estimated the number of acres oiled, the degree of oiling, and the associated degree and duration of injury associated with the oiling. Specific habitat types included sandy beaches and rocky intertidal areas. This injury quantification information was then used in a Habitat Equivalency Analysis (HEA) to scale restoration of dunes and wetlands (see Appendix J).

4.2.3 Damage Assessment Methods for Recreational Use

For recreational use impacts, the Trustees and Bean commissioned a joint study by consultants that sought to place a direct dollar value on the loss to the public. The consultant used the following approach:

[5] Biologically, this could occur if the population was at carrying capacity with respect to breeding opportunities (perhaps limited by available nesting habitat or food base during the nesting season). The loss of some adults would open up room for other adults to take over the vacant nesting opportunities and thus maintain the population's annual production of juveniles.

1. Determined the types of recreational activities impacted.
2. Quantified the number of trips lost due to closures of beaches and boat ramps.
3. Quantified the number of trips diminished in value due to the spill.
4. Determined appropriate values per trip for various activities, based on previous economic studies of the value of outdoor recreation.
5. Multiplied the value per trip or diminished trip by the number of affected trips to arrive at a final lost value figure.

The full report on the recreational use injury assessment and results can be found in the Administrative Record (see section 3.1.1.4. for information on accessing Administrative Record documents).

4.2.4 Restoration Project Selection Criteria

The Trustees considered numerous restoration alternatives to compensate the public for spill-related injuries. Each restoration alternative was evaluated using the following screening criteria:

Phase I - INITIAL SCREENING CRITERIA: The following screening criteria were used to select the preferred and non-preferred restoration projects presented in this final DARP.

A. **Consistency with Trustees' Restoration Goals.** Projects must meet the Trustees' intent to restore, rehabilitate, replace, enhance, or acquire the equivalent of the injured resources and resource services.

B. **Technical Feasibility.** The project must be technically and procedurally sound. Consider the level of risk or uncertainty and the degree of success of projects utilizing similar or identical techniques in the past.

C. **Cost-Effectiveness.** Consider the relationship of expected project costs to expected resource and service benefits. Seek the least costly approach to deliver an equivalent or greater amount and type of benefits.

D. **Relationship to Injured Resources and/or Services (nexus).** Projects that restore rehabilitate, replace, enhance, or acquire the equivalent of the same or similar resources or services injured by the spill are preferred to projects that benefit other comparable resources or services. 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.

E. **Time to Provide Benefits.** Consider the time it takes for benefits to be provided to the target ecosystem, species, or public to minimize interim resource loss (sooner = better).

F. **Duration of Benefits.** Consider the expected duration of benefits from the project. Long-term benefits are the objective.

Phase II - ADDITIONAL SCREENING CRITERIA: To the extent that sufficient information was available, these additional criteria were used during the preferred restoration project identification process. These additional screening criteria will be used to further evaluate

preferred projects for funding and implementation. The following additional criteria are not considered to be of lesser importance than the initial screening criteria. However, these criteria are generally more appropriately applied after more detailed project plans and scopes of work are developed.

G. **Avoidance of Adverse Impacts.** The project should avoid or minimize adverse impacts to the environment and the associated natural resources. Adverse impacts may be caused by collateral injuries when implementing, or as a result of implementing, the project. Consider avoiding future short-term and long-term injuries as well as mitigating past injuries.

H. **Likelihood of Success.** Consider the potential for success and the level of expected return of resources and resource services. Consider also the ability to evaluate the success of the project, the ability to correct problems that arise during the course of the project, and the capability of individuals or organizations expected to implement the project.

I. **Compliance with Applicable Federal, State, and Local Laws and Policies.** The project must comply with applicable laws and policies.

J. **Public Health and Safety.** The project must not pose a threat to public health and safety.

K. **Maintenance and Oversight of Project.** Consider the opportunities to protect the implemented project and resulting benefits over time through conservation easements, land acquisition, or other types of resource dedication. Long-term protection is preferable.

L. **Opportunities for Collaboration.** Consider the possibility of matching funds, in-kind services, volunteer assistance, and coordination with other ongoing or proposed projects. External funding and support services that reduce costs or extend benefits are preferable. Funds, however, shall not be used to offset the costs of ongoing mitigation projects required pursuant to state or federal law.

M. **Total Cost and Accuracy of Estimate.** The total cost estimate should include costs to design, implement, monitor, and manage the project. Its validity is determined by the completeness, accuracy, and reliability of methods used to estimate costs, as well as the credibility of the person or entity submitting the estimate.

Phase III - SUPPLEMENTAL CRITERIA: The following criteria were considered when appropriate (*e.g.*, as a tie-breaker in the case of more than one project being equally preferred after Phase I and II evaluations).

N. **Multiple Resource and Service Benefits.** Consider the extent to which the project benefits more than one injured natural resource or resource service. Measure in terms of the quantity and associated quality of the types of natural resources or service benefits expected to result from the project.

O. **Comprehensive Range of Projects.** Consider the extent to which the project contributes to the more comprehensive restoration package. Evaluate the project for the degree to which it benefits any otherwise uncompensated spill injuries.

P. **Ability to Document Benefits to the Public.** Consider the ability to document receipt or delivery of benefits to the public as a result of the project.

Q. **Educational/Research Value.** Consider the project's potential for public education and outreach and/or clarification of restoration planning issues.

R. **Non-Duplication.** Projects should not duplicate other efforts already ongoing at the same location.

4.3 Injury Quantification and Restoration Alternatives by Category

The following sections provide the details regarding injury quantification, the range of potential restoration options, and, for each injury category, a description of the preferred restoration project and the scaling of the size of that project.

4.3.1 Loon and Grebe Injury and Restoration

This grouping of species lumps two orders of birds: loons (*Gaviiformes*) and grebes (*Podicipediformes).* These two orders are quite similar. Both are duck-like birds that spend most of their lives floating on the water and diving for fish. All of these species nest on inland lakes along marsh edges and winter in near-shore ocean waters and/or inland lakes. Their nests are constructed of small islands of vegetation that sit low in the water.

Two species, Common Loon and Western Grebe, account for 81% of the estimated impacted birds from this species group. Both of these species occur regularly along the California coast in winter. No loons currently nest in California, although Common Loons historically nested in small numbers in northeastern California (Grinnell and Miller 1944). Loon nesting in western North America is largely restricted to undisturbed portions of Alaska and Canada (McIntyre and Barr 1997). The Common Loon is listed as a California State Species of Special Concern.

Western Grebe populations have declined significantly in the past 25 years. Data from Christmas Bird Counts reveal that total Western Grebe counts have fallen from approximately 80,000 in 1980 to just over 40,000 in recent years. Western Grebes nest in dense colonies, although they are also known to solitarily nest. The majority of California's grebes nest in a few colonies that are so concentrated that a single disturbance event by a boat could destroy the majority of a colony's breeding attempt in any given year. Grebe nesting colonies in California are subject to several factors that may reduce or eliminate nest productivity in any given year: wave wash from boat wakes, disturbance and direct destruction of nests from boats or personal watercraft (*e.g.*, jet-skis), sudden changes in water levels (Ivey 2004), and potentially reduced food supplies. Western Grebes nest in scattered locations in the northern half of the state. The largest colonies (greater than 300 nests) are at:

- Eagle Lake in Lassen County,
- Tule Lake National Wildlife Refuge (North Sump) in Siskiyou County,
- Clear Lake in Lake County, and
- Lake Almanor in Plumas County (personal communication, G. Ivey).

These four lakes comprise over 80% of the approximately 10,000 Western and Clarks' Grebes that nest in the state (Ivey 2004). In the vicinity of the spill site, up to 100 pairs of Western Grebes nest at Lake Earl in Del Norte County (personal communication, T. Williamson).

4.3.1.1 Injury Quantification

There were 48 birds collected in this species group. The total estimated dead was 77, implying a total dead-bird multiplier of slightly less than two. This relatively low multiplier was due to the proximity of the oil and these species to the shoreline, the thorough search effort, and the fact that most of the species in this group are large-bodied birds.

	Collected Alive		Collected	Total	Total
Species	**Released**	**Died**	**Dead**	**Collected**	**Estimated Dead**
Red-throated Loon	0	5	0	5	7
Common Loon	7	17	0	24	38
Pied-billed Grebe	0	0	1	1	1
Eared Grebe	0	0	1	1	6
Western Grebe	3	1	12	16	24
grebe, sp.	0	0	1	1	1
TOTAL	**10**	**23**	**15**	**48**	**77**

Because population data was not available for every species, lost bird-years were calculated relying on the demographic characteristics of Common Loon (for the loons) and an average of grebe species (for the grebes), as described in Sperduto et al. (1999). See Appendix C for details. The Trustee-RP technical working group agreed to apply the single-generation stepwise replacement approach to calculating lost bird-years, as described in the Methods section above. Using this approach results in the following estimates:

Species	**Total Estimated Dead**	**Bird-Year Multiplier**	**Total Lost Bird-Years**
Red-throated Loon	7	7.22	50
Common Loon	38	7.22	274
Pied-billed Grebe	1	2.78	3
Eared Grebe	6	2.78	17
Western Grebe	24	2.78	67
grebe, sp.	1	2.78	3
TOTAL	**77**		**414**

These lost bird-years represent the interim losses between the time of the spill and return of these populations to pre-spill conditions. Thus, any restoration project benefiting this species group should seek to replace 414 lost bird-years.

4.3.1.2 Restoration Alternatives

Restoration options for loons and grebes on their wintering grounds are limited. Furthermore, because their populations are most likely limited by pressures on their nesting grounds, it makes most sense to focus restoration at these locations. Because Common Loons and Western Grebes were the predominant species impacted, the Trustees examined potential restoration options for these species. Restoration for Common Loons would require actions far removed from the spill

area, most likely in Canada or Alaska. Specific restoration projects in these areas have not been identified.

Two projects were considered for benefiting grebes in California, which are listed in the table below.

PROJECT CONCEPT	BENEFITS
Acquisition of land around Lake Earl to allow for higher lake levels and increase Western Grebe nesting	Western Grebe
Protection of grebe nesting colonies at northern California lakes	**Western/Clark's Grebes**

After evaluating these projects using the initial and additional screening criteria, the Trustees identified the Lake Earl project as a tentative preferred project in the draft DARP. However, since the preparation of the draft DARP, the Trustees have obtained more information about the other project benefiting grebes. This new information indicates that the colony protection project will provide more cost-effective and timely benefits than the Lake Earl project. Therefore, the Trustees have selected the colony protection project as the preferred project for this restoration category.

Protection of Western/Clark's Grebe Nesting Colonies at Northern California Lakes:
This project would fund many of the recommendations of the California grebe management plan (Ivey 2004), designed to protect Western and Clark's Grebe nesting colonies from human disturbance and other perturbations. These two species nest together and, as described above, are subject to disturbances when nesting; conservation issues for each species are identical and inseparable. These disturbances, usually from close approach by boats or personal watercraft (*e.g.*, jet-skis) can result in nest abandonment or direct loss of chicks, eggs, or nest. The colonies considered for protection are located at Clear Lake, Eagle Lake, Lake Almanor, Tule Lake NWR, and the Thermolito Forebay. Clear Lake will be the top priority because disturbance there is most pronounced. Monitoring at other lakes will aid in identifying and prioritizing opportunities for implementing the project at additional sites.

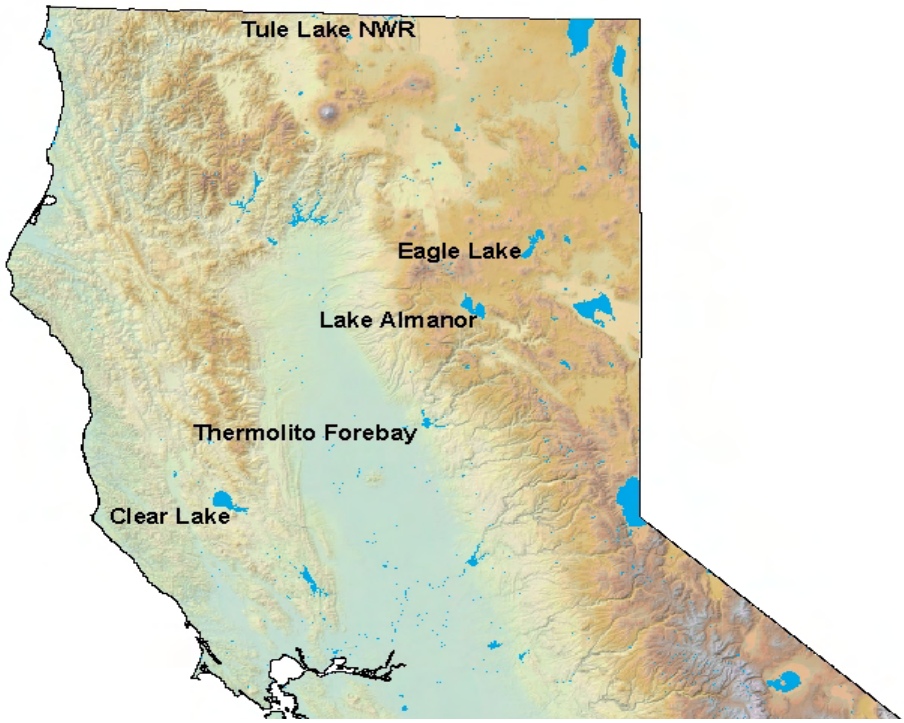


Figure 4: Grebe colony protection sites.

Protective actions will include public education and outreach and the establishment of small seasonal buffers around grebe nesting colonies. Public education will include pamphlets and signs around boat launches, marinas, campgrounds, and other public places. Seasonal buffers will be marked with buoys and signs, typically within 100 to 200 yards of the shoreline where nests are located in emergent vegetation. All of these efforts will be coordinated with local enforcement and government officials. Other actions may include protection and restoration of emergent vegetation.

This project will expand upon a current two-year pilot project at Clear Lake initiated by the *American Trader* oil spill Trustee Council. The settlement funds allocated for this project total $100,000 for one year**.**

4.3.1.3 Scaling for Primary and Compensatory Restoration

As section 4.3.1.1 described, the total injury to this restoration category was 414 lost bird-years. For restoration scaling, the Trustees relied on data from Clear Lake that suggest grebe colony protection measures may result in an increase of 0.295 fledges per nest for each year of the project. Assuming that project benefits begin in the year 2007 and last one year, the Trustees calculated that such a project would generate 592 additional bird-years resulting from the increased nest success. This would more than compensate for the injury. However, because project is only divisible by years, the Trustees recommend a one-year project.

Appendix D provides additional details regarding the bird REA for this species group.

4.3.1.4 Environmental Consequences (Beneficial and Adverse)

Beneficial Effects

This project will lead to increased nest success for Western and Clark's Grebes. Further, it will serve to protect important nesting colonies. The public will also be educated regarding behavior and characteristics of these attractive and conspicuous birds.

Adverse Effects

There are no adverse impacts anticipated for wildlife and habitat, as this project will protect areas from human disturbance. There will be minor inconveniences to boaters and users of personal watercraft, as grebe colonies will be protected by buffers that restrict boating access. However, these buffers are relatively small, extending only 50 to 100 meters from shore, and span only the length of shoreline where the colonies are located. Given the size of these lakes, these buffers typically represent less than 1% of the total lake surface area. Additionally, the buffers are seasonal, as they are only needed during the breeding season (primarily July and August).

4.3.1.5 Probability of Success

As the primary goal of this project is to modify human behavior, successfully protecting grebe colonies from all human disturbances is difficult to achieve. It is likely there will be a low level of disturbance regardless of the project. Nevertheless, this project should reduce the probability of the kind of catastrophic disturbance events that have occurred in the past. If so, nest success should stabilize at more natural levels each year, thus resulting in project success.

4.3.1.6 Performance Criteria and Monitoring

The goal of this project is to prevent disturbance of nests and to ensure that the juvenile/adult ratio does not fall below 0.35 due to human disturbance in any one year. To measure both compliance and grebe nest success, the project provides for monitoring during each breeding season. Grebes will be monitored using both aerial and boat surveys, according to current protocol and previous surveys as described in Ivey (2004).

4.3.1.7 Evaluation

The Trustees have evaluated this project against the initial 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 project would effectively compensate for injuries to loons and grebes that occurred as a result of the Spill and have identified this project as a preferred project.

4.3.2 Pelican, Cormorant, and Gull Injury and Restoration

This species grouping includes all pelicans, cormorants, and large gulls collected during the spill response. These species share several characteristics: they all forage in near-shore waters and in bays, they all spend considerable time out of the water roosting on rocks or other platforms, and they are frequently found roosting and foraging together.

The California Brown Pelican is listed as a state and federal endangered species. Nesting occurs in Mexico and on islands off southern California; the pelican occurs in Humboldt County during the non-breeding season as a seasonal migrant, primarily during fall and winter. Brown pelicans typically forage in relatively shallow coastal waters, feeding almost entirely on surface-schooling fish caught by plunge diving in coastal waters. Brown pelicans are rarely found away from salt water and do not normally venture more than 32 kilometers (20 miles) out to sea. During the non-breeding season, brown pelicans roost communally; roosting sites and loafing areas are essential habitat for local individuals and Mexican migrants. Since brown pelicans have wettable plumage, they require terrestrial roost sites so that they can dry their feathers after feeding or swimming (Jaques and Anderson 1987). Roost sites are also important for resting and preening. The essential characteristics of roosts include: nearness to adequate food supplies; presence of physical barriers to predation and disturbance; sufficient surface space for individuals to interact normally; and adequate protection from adverse environmental factors such as wind and surf (Jaques and Anderson 1987). Major roosts are found on jetties and other manmade structures, offshore islands and rocks, and the beach at the mouths of estuaries (Jaques and Anderson 1987). In many sections of the coast, such roosting sites are in short supply (Jaques 1994; Jaques and Strong 2002).

Double-crested, Brandt's, and Pelagic Cormorants (*Phalacrocorax auritus*, *P. penicillatus*, *P. pelagicus* occur in California year-round. The latter two species are found strictly along the coast, while Double-crested occurs inland as well. The Double-crested Cormorant has also been listed as a California Species of Special Concern as a result of impacts from human disturbance, habitat destruction, and DDT in past decades. Like the pelican, these species require disturbance-free roost sites to enable them to rest and dry their plumage after foraging for fish in the water. Likewise, their nesting is limited to disturbance-free areas, typically small offshore rocks and human-made structures (*e.g.*, abandoned piers).

Both Western Gulls and Glaucous-winged Gulls occur primarily along the coast. The Western Gull breeds in California and is present year-round, while the Glaucous-winged Gull breeds north of California and is present primarily in the winter months. Both species nest on offshore rocks and other platforms, frequently in close proximity to cormorants.

4.3.2.1 Injury Quantification

There were 73 birds collected in this species group. The total estimated dead was 139, implying a total dead-bird multiplier of slightly less than two. This relatively low multiplier was due to the proximity of the oil and these species to the shoreline, the thorough search effort, and the fact that all of the species in this group are large-bodied birds.

Species	Collected Alive		Collected Dead	Total Collected	Total Estimated Dead
	Released	Died			
Brown Pelican	0	1	1	2	3
Brandt's Cormorant	1	2	9	12	23
Double-cr. Cormorant	0	0	12	12	25
Pelagic Cormorant	0	0	4	4	8
cormorant, sp.	0	0	3	3	4
Western Gull	0	9	18	27	52
Glaucous-winged Gull	0	1	2	3	6
gull, sp. (large)	0	0	9	9	18
TOTAL	**1**	**13**	**59**	**73**	**139**

Because population data was not available for every species, lost bird-years were calculated relying on the demographic characteristics of Brown Pelicans, Double-crested Cormorants (for all cormorants), and Western Gulls (for all gulls). See Appendix C for details. The Trustee-RP technical working group agreed to apply the single-generation stepwise replacement approach to calculate lost bird-years, as described in the Methods section above. Using this approach results in the following estimates:

Species	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Brown Pelican	3	6.20	19
Brandt's Cormorant	23	4.44	102
Double-cr. Cormorant	25	4.44	111
Pelagic Cormorant	8	4.44	36
cormorant, sp.	4	4.44	18
Western Gull	52	4.50	234
Glaucous-winged Gull	6	4.50	27
gull, sp. (large)	18	4.50	81
TOTAL	**139**		**627**

These lost bird-years represent the interim losses between the time of the spill and return of these populations to pre-spill conditions. Thus, any restoration project benefiting this species group should seek to replace 627 lost bird-years.

4.3.2.2 Restoration Alternatives

The restoration concepts for this group of species share one goal: to provide roosting benefits for Brown Pelicans. Some of the projects provide nesting benefits for cormorants, nesting or roosting benefits for gulls, as well as a variety of other species and services outside the restoration category. These potential projects are listed in the table below.

PROJECT CONCEPTS	BENEFITS
Pelican roost site protection	**Brown Pelicans, cormorants, gulls**
South Spit of Smith River acquisition and management (57 acres of dune/sand)	Brown Pelicans, gulls, shorebirds, Snowy Plovers
Island Roost at Lake Talawa – building up the island above high water	Brown Pelicans, cormorants, gulls, Snowy Plovers, shorebirds, Aleutian Cackling Geese
Artificial Pelican Roosts – float at Samoa Bridge and tree in Crescent City Harbor	Brown Pelicans, cormorants, gulls,
Old Arcata Wharf Restoration – refurbishing and enlarging of	Double-crested Cormorant, Brown Pelicans

abandoned wharf	
South Spit of Humboldt Bay acquisition (627 acres of dune and salt marsh) – protection from disturbances	Snowy Plover, shorebirds, pelicans, human recreational. use
Pelican roost at North Jetty on North Spit – cut off to create an island	Brown Pelicans
Pelican signs on South Spit – to reduce human disturbances	Brown Pelicans

After evaluating these projects using the initial and additional screening criteria, the Trustees identified the Arcata Wharf project as a tentative preferred project in the draft DARP. Land acquisition and increasing the size of the island at Lake Talawa were deemed not cost effective; the South Spit of Humboldt Bay has recently been acquired and is being managed to protect the natural resources; and other projects are more proximal than the Crescent City project. However, since the preparation of the draft DARP, the Trustees have obtained more information indicating that the Arcata Wharf project is potentially in conflict with other agency goals to focus on more natural solutions. Therefore, the Trustees have selected the **pelican roost site protection project** as the preferred project for this restoration category. Protection of pelicans on the North Jetty and South Spit can be incorporated into the preferred project described below.

Brown Pelican Roost Site Protection: The objective of this project is to protect Brown Pelican roost sites from human disturbance. Communal roost sites are essential for Brown Pelicans at all times of year throughout their range (Gress and Anderson 1983, Jaques 1994). Brown Pelicans are unlike many seabirds in that they have wettable plumage (Rijke 1970) and will become heavy and hypothermic in cold water if they do not come ashore regularly to dry and restore their plumage. Brown Pelicans spend a large portion of their daily time budget at terrestrial roosts. These birds have many behavioral adaptations, including careful habitat selection, in order to conserve energy, as they are among the heaviest flying birds (Pennycuik 1972).

Roost site selection is based on proximity to prey resources, isolation from potential predators and human disturbance, and microclimate features that aid in thermoregulation. The primary roost sites for Brown Pelicans in the western US are offshore rocks and islands on the outer coast, and sand islands within large estuaries (Briggs *et al.* 1987, Jaques 1994). Intense shoreline development, wetland filling, and other habitat alteration has eliminated much of the natural onshore roost habitat. Loss of historic roost 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 in California (Jaques *et al.* 1996). Pelicans spread out to a larger number of roosts by day and gather into a smaller number of highest quality roosts at night. Island-type habitat is generally required at night to protect them from disturbance. Major night roosts support hundreds to thousands of pelicans on a given night (Briggs and Chu 1987, Jaques and Anderson 1988, Jaques *et al.* 1996).

In the Humboldt Bay area, pelicans are most common in the fall. There are plentiful roosting locations within the bay during low tide on exposed mudflats. However, high tide roost sites are much more limited.

This project may partner with the Bureau of Land Management and the California Coastal National Monument to protect pelican roosts in the Humboldt Bay area, as well as roost sites to the north in Del Norte County. The project will flexibly respond to disturbance issues as they arise or are anticipated. While specific measures will be tailored to the needs at each location, potential project elements include:

- Initial survey to identify vulnerable pelican roosts
- Public education and outreach via signs and educational materials
- Placement of buoys at strategic locations
- Protective fencing or signage
- Other measures to protect pelican roost sites
- Annual monitoring and adaptive management

Some of the locations targeted by the project may include locations around Humboldt Bay, Trinidad Head, and the mouths of rivers and streams (*e.g.*, Elk, Eel, Smith, etc.). Some outreach and education elements of this project may be combined with murre colony protection efforts.

4.3.2.3 Scaling for Primary and Compensatory Restoration

As section 4.3.2.1 described, the total injury to this restoration category was 627 lost bird-years. The Trustee-RP technical working group focused on cormorant nesting for restoration scaling, estimating the increased number of bird-years that would be derived from additional nests assuming the Old Arcata Wharf project would be implemented. Appendix E provides additional details regarding the bird REA for this project. However, after releasing the Draft Restoration Plan, the Trustees received comments that have caused them to re-consider the Old Arcata Wharf project and have replaced it with the more preferred Brown Pelican Roost Site Protection Project. The Trustees believe the funds recovered based on scaling of the Old Arcata Wharf project costs will provide adequate benefits via the adaptive management strategy of the roost site protection project. The settlement funds allocated for this project total $91,000.

4.3.2.4 Environmental Consequences (Beneficial and Adverse)

Beneficial Effects
Protection of pelican roosts will have positive benefits to pelicans by reducing energy costs associated with commuting between prey and roosts, and with flushing and relocating due to human disturbance. Reducing energy expenditures should result in improved body condition of individual birds, which should lead to increased juvenile and adult survival and increased reproductive success of pelicans.

Cormorants and gulls often roost and nest at the same locations where pelicans roost. To the extent that this occurs at locations protected by this project, these species will benefit as well.

Adverse Effects
This project will rely primarily on education and outreach, encouraging voluntary compliance to protect roosting pelicans. This project has the potential to restrict human access to small areas (*e.g.*, tips of jetties) seasonally; any access restrictions will be carefully considered. Likewise, signs will be carefully designed and located so as not to detract from the natural beauty of any area.

4.3.2.5 Probability of Success

Education and awareness programs, including displays, signs, and brochures nearly always attract public attention. If done well, experience has demonstrated that such programs instill in the public new knowledge and appreciation of the subject considered. Informational and warning signs to protect seabirds are likely to reduce human behaviors that are detrimental to the resource.

4.3.2.6 Performance Criteria and Monitoring

The project will include on-going surveillance and monitoring to guide project implementation and evaluate success. The primary performance criterion is the maintenance of an adequate supply of disturbance-free roost sites for all pelicans from Humboldt Bay to Crescent City.

4.3.2.7 Evaluation

The Trustees have evaluated this project against initial and additional screening criteria developed to select restoration projects (see Section 4.3.2.2) and concluded that this project is consistent with these selection factors. The Trustees determined that this type and scale of project would effectively compensate for injuries to pelicans, cormorants, and gulls, and have identified this project as a preferred project.

4.3.3 Common Murre, Other Alcids (except Marbled Murrelet) and Procellarid Injury and Restoration

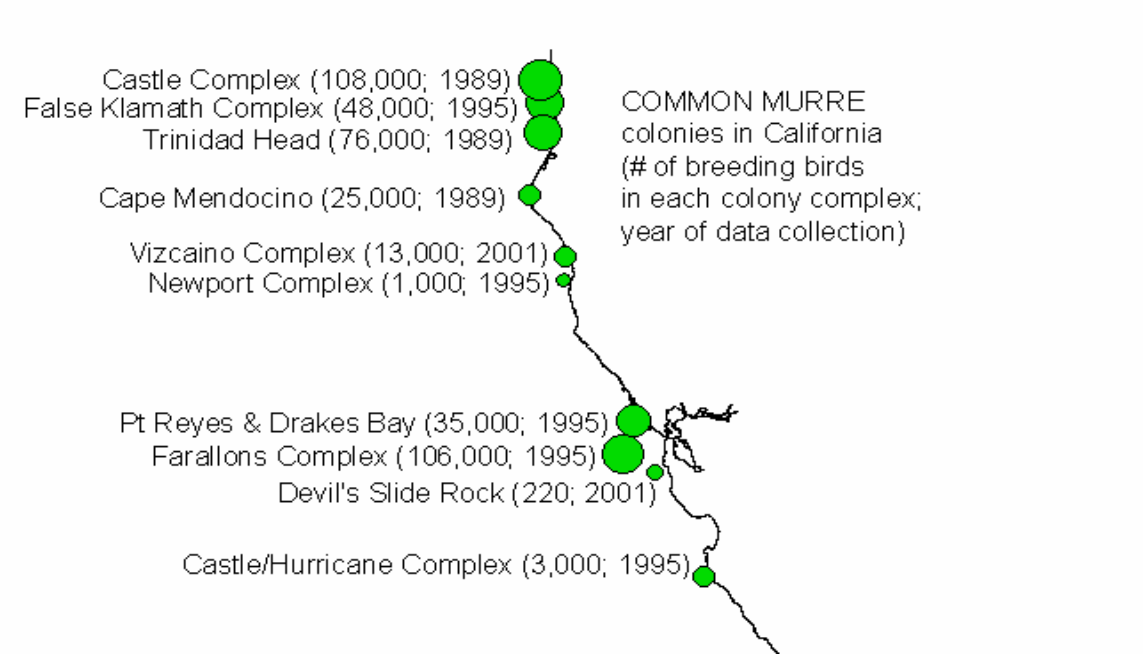
This grouping of species includes alcids (except Marbled Murrelets) and Procellarids. Alcids are small to medium-sized seabirds, resembling ducks or small penguins (although they are capable of flight). Alcids spend much of their lives at sea, where they swim on the surface and dive for fish. They typically nest, often in large colonies, on cliff edges or in burrows on islands or remote headlands along the coast. Puffins are the most well-known members of the alcid family. Procellarids, also called tubenoses, are highly pelagic seabirds resembling gulls, though they are typically longer-winged and have a more graceful, arcing flight. Procellarids spend most of their lives at sea, where they travel great distances soaring low over the waves, stopping to land on the water wherever food is available. They typically nest on remote islands or cliffs. Albatrosses are the largest and most well-known Procellarids.

In addition to their highly pelagic habits and preference for remote nesting locations, alcids and Procellarids have other similarities: they are among the longest-lived and slowest reproducing of all birds, with some species rearing only one chick a year (if they nest at all) and often living in excess of 20 or 30 years.

Within this grouping, one species (the Common Murre) accounts for 83% of all estimated mortalities to this bird group. The Common Murre, despite its name, has a population that is well below historical levels. It is estimated that over a million birds once nested on the Farallon Islands alone (Carter et al. 2001). Beginning in the late 1800s, hunting, egging, human disturbance, and oil pollution took a tremendous toll on the birds. By 1959, less than 10,000 birds remained on the Farallon Islands. Since then, however, numbers have increased, although with some setbacks due to oil spills and gill-netting. Today, with gill-netting, hunting, and

egging eliminated, the murre population throughout the state is steady or slightly increasing on a slow recovery towards historical levels.

To a large degree, the nesting colonies in California can be divided into two regions: northern California (encompassing Del Norte, Humboldt and Mendocino Counties) and central California (encompassing the Gulf of the Farallones region to Big Sur). From 1979-95, Common Murres were recorded breeding at 13 locations in northern California: Del Norte County (Castle Rock, Sisters Rocks, and False Klamath Rock); Humboldt County (Reading Rock, White Rock, Green Rock, Flatiron Rock, Blank Rock, Pilot Rock, False Cape Rocks, and Steamboat Rock); and Mendocino County (Rockport Rocks and Cape Vizcaino) (Carter et al. 2001). Since 1995, murres also have bred at Newport Rocks, Kibesillah Rock, and Goat Island Area in Mendocino County.



Focusing on the northern California colonies, Carter et al. (2001) note that "murres currently use much of the available and suitable breeding habitat on all large islands in Del Norte and Humboldt counties, although breeding densities could increase further." They then note that suitable locations that lack murre colonies are subject to human disturbance.

4.3.3.1 Injury Quantification

Just over one thousand birds in this species group were collected after the Spill. The total estimated dead was just under two thousand, implying a total dead-bird multiplier of slightly less than two. This relatively low multiplier was due to the proximity of the oil to the shoreline, the thorough search effort, and the fact that most of the species in this group are large-bodied birds.

Species	Collected Alive		Collected Dead	Total Collected	Total Estimated Dead
	Released	Died			
Laysan Albatross	0	0	1	1	2
Northern Fulmar	0	0	5	5	10
Pink-footed Shearwater	0	0	2	2	3
Buller's Shearwater	0	0	3	3	10
Sooty Shearwater	0	0	14	14	27

Common Murre	253	295	390	938	1,600
Pigeon Guillemot	3	8	12	23	74
Cassin's Auklet	0	0	17	17	60
Rhinoceros Auklet	6	7	33	46	150
Tufted Puffin	0	0	1	1	1
TOTAL	**262**	**310**	**478**	**1,050**	**1,937**

Because population data were not available for every species, lost bird-years were calculated relying on the demographic characteristics of Northern Fulmar (for fulmar and albatross), Sooty Shearwater (for the shearwaters), and Common Murre (for the alcids). See Appendix C for details. The Trustee-RP technical workgroup agreed to apply the single-generation stepwise replacement approach to calculating lost bird-years, as described in the Methods section above. Using this approach results in the following estimates:

Species	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Laysan Albatross	2	12.7	25
Northern Fulmar	10	12.7	127
Pink-footed Shearwater	3	12.7	38
Buller's Shearwater	10	12.7	127
Sooty Shearwater	27	12.7	343
Common Murre	1,600	7.2	11,488
Pigeon Guillemot	74	7.2	531
Cassin's Auklet	60	7.2	431
Rhinoceros Auklet	150	7.2	1,077
Tufted Puffin	1	7.2	7
TOTAL	**1,937**		**14,194**

These lost bird-years represent the interim losses between the time of the Spill and return of these populations to pre-spill conditions. Thus, any restoration project benefiting this species group should seek to replace 14,194 lost bird-years.

4.3.3.2 Restoration Alternatives

Restoration options for Procellarids (in this case, primarily shearwaters) are quite limited. As a result, the Trustees did not identify any practicable restoration options for these species. Instead the Trustee-RP technical working group focused on Common Murres, the species most impacted by the spill (with respect to number of individuals oiled). While restoration options exist for some of the other alcids besides Common Murres, the projects brought to the Trustees' attention were rather small and experimental. The table below lists all projects considered to benefit this species group.

PROJECT CONCEPTS	BENEFITS
Trinidad Seabird Colonies – re-colonization of Tufted Puffin at Green and Puffin Rocks	Tufted Puffin
Trinidad Seabird Colonies – re-colonization of Common Murre at Sea Lion Rock	Common Murre
Trinidad Seabird Colonies – enhance nesting habitats for Leach's Storm-Petrel at Little River and Prisoner Rocks	Leach's Storm-Petrel
Whaler Island Restoration (Crescent City Harbor) – re-establish it as a seabird colony	Leach's Storm-Petrel, Fork-tailed Storm-Petrel, Common Murre, Pigeon Guillemot, Cassin's Auklet, Western Gull

Human Disturbance Reduction Program – for Humboldt and Del Norte County seabird colonies	Common Murre, alcids (except Marbled Murrelet), storm-petrels
Cape Vizcaino Area seabird colonies – acquisition and management	Common Murre, alcids (except Marbled Murrelet), cormorants, gulls, Black Oystercatcher
Reading Rock murre re-colonization and protection	**Common Murre**

Because Common Murres represent the vast majority of birds in this category, and were determined by the technical working group to be a surrogate for all other species in this category, those projects which do not benefit murres were screened out. After evaluating the remaining Common Murre projects using the initial and additional screening criteria, the Trustees identified contribution to the restoration of a murre colony at Reading Rock as the preferred project. This project will restore murres at a location most proximate to the spill site and redress impacts caused from past and on-going human disturbance. In addition, it will benefit a highly impacted murre colony using restoration methods that are known to be effective.

Reading Rock Murre Re-colonization Project: This project would restore a depleted Common Murre colony on Reading Rock, which is located 4 miles off Gold Bluff Beach in Humboldt County. This offshore rock is part of the California Coastal National Monument and is managed by BLM in cooperation with the Yurok Tribe. Reading Rock is of cultural importance to the Yurok Tribe which traditionally hunted sea lions there. Common Murres nest on the rock, and California Sea Lions haul out on the rock. While murre numbers at most colonies in northern California have been stable or increasing, Reading Rock is a notable exception. Numbers of breeding murres were variable between 1979 and 1989 (ranging from 800–2,100 birds; Carter et al. 2001) but have declined since 1995. By 2002, no breeding murres were noted during aerial surveys, although some may have attended prior to surveys. A detailed description of the demise of this colony requires counting several years of archived aerial photographs (1987 to 2002). Colony extirpation seems imminent due to the following causes: human disturbance by USCG crews which service the automated light; probable aircraft and boat disturbances; California sea lions hauling out high on the rock; and mortality from the 1997 *Kure* and 1999 *Stuyvesant* oil spills. Natural re-colonization or recovery likely will not occur in the near future without restoration efforts.

Restoration actions would include: a) cooperation between USCG, Federal Aviation Administration (FAA), CDFG, and other state and federal agencies, as well as the Yurok Tribe, to prevent human disturbance of murres (including prohibiting landing and low overflights, plus installing buoys to mark boat closures within ~200 m of the rock); b) installation of small barriers to keep sea lions off the top areas of the rock (barriers have been used elsewhere for sea lions and topography at Reading Rock would assist their effectiveness); and c) use of social attraction techniques (*e.g.*, decoys, recorded vocalizations, and mirrors) to attract murres to Reading Rock (especially recent breeders that are more likely to rapidly re-colonize). Monitoring would be achieved by aerial photography because the rock is located three miles from shore. By employing several restoration techniques in the next few years, permanent colony extirpation may be avoided and the colony should return to higher levels than seen since 1979, given the amount of suitable nesting habitat available. The available settlement funds for this project total $500,000; additional funding is anticipated from other oil spill settlements.

4.3.3.3 Scaling for Primary and Compensatory Restoration

As section 4.3.3.1 described, the total injury to this restoration category was 14,240 lost bird-years. For restoration scaling, the Trustee-RP technical working group relied on data from the Devil's Slide Rock Common Murre Re-colonization Project off the Central California coast. This project has many similarities to the proposed Reading Rock project: 1) both projects seek to re-colonize murres to offshore rocks; 2) the potential colony size on each rock is quite similar; and 3) the techniques to be employed are identical.

Using data from the first seven years (1996-2002) of the Devil's Slide Rock project (Knechtel, et al. 2003), and assuming continued growth in colony size until maximum colony size is reached, such a project would generate 49,184 additional bird-years over the course of 100 years. Because 14,194 bird-years were lost due to the spill, the Trustees conclude that a project approximately 29% of the size of the Devil's Slide Rock project would be appropriate to compensate for the injury to these birds. Thus, the Trustees are recommending a 29% contribution toward the Reading Rock project. Additional funding may be available from other oil spill damages (*e.g.*, *Kure*) as well as other sources.

Appendix F provides additional details regarding the bird REA for this species group.

4.3.3.4 Environmental Consequences (Beneficial and Adverse)

Beneficial Effects

This project is designed to reestablish a Common Murre colony. In the long run, this will lead to an overall increase in the number of murres in Humboldt County, as well as an increase in the number of colonies. Education of government agencies and the public will also be achieved as part of this project, which may lead to greater awareness regarding human disturbances at other seabird colonies.

Adverse Effects

The adverse impacts associated with this project are minimal. USCG's maintenance of the automated navigational light should not be affected. The USCG recently reached an agreement with BLM regarding the maintenance of the light. Under the terms, USCG maintenance will be scheduled for periods outside of the Common Murre nesting season and will seek to minimize disruption of the natural resources. California sea lions will continue to have access to much of the lower reaches of the rock, where the majority of sea lions haul out. The restriction of recreational fishing around the rock will be small and limited to the nesting season. Moreover, a balance will be sought between minimizing the impacts on the resource and preserving quality opportunities for recreation. Anglers and boaters from Humboldt Bay to Eureka will be notified of any buoys and restricted areas in order to minimize inconvenience. If appropriate, additional environmental compliance specifically for this project will be conducted prior to implementation.

4.3.3.5 Probability of Success

Social attraction techniques (*e.g.*, the use of decoys) to reestablish a murre colony have been successfully used in central California. This project will replicate those techniques. Because

murres have used Reading Rock in the recent past and because there are many murres in the area, the Trustees believe this project will be successful. The educational components of this project will likewise draw on materials and methods developed for a successful human disturbance reduction project in Oregon. By employing these restoration techniques in the next few years, permanent colony extirpation should be avoided and the colony should eventually return to the highest levels since 1979, given the amount of suitable nesting habitat available.

4.3.3.6 Performance Criteria and Monitoring

The project also contemplates 10 years of monitoring in order to measure increases in murre attendance at the rock. Because of the remote location of the rock, the monitoring will rely on aerial photographs and will not be able to measure nest productivity. This is a standard method for documenting murre breeding effort.

4.3.3.7 Evaluation

The Trustees have evaluated this project against initial and additional 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 project would effectively provide appropriate compensation for injuries to murres, other alcids (except Marbled Murrelet), and Procellarids that occurred as a result of the Spill and have identified this project as a preferred project.

4.3.4 Marbled Murrelet Injury and Restoration

The Marbled Murrelet is a small seabird in the alcid family found along the Pacific Coast from Alaska to California. At sea, it feeds by diving for small fish in near-shore waters, typically within 5 km of the coastline. Unlike most alcids, the Marbled Murrelet nests up to 50 km (most within 30 km) inland in late-successional and old-growth coniferous forests. In California, it nests almost exclusively in redwoods (*Sequoia sempervirens*) older than 200 years (Nelson 1997). Like most alcids, the Marbled Murrelet is a long-lived slow-reproducing species, laying only one egg per year. Given these demographic characteristics, the vast majority of the population consists of breeding adults, whose survival is critical to sustaining the species (Beissinger 1995).

The Marbled Murrelet was federally listed as a threatened species in Washington, Oregon and California on September 28, 1992 (U.S. Fish and Wildlife Service 1992). The draft recovery plan was released on August 1, 1995 and the final recovery plan was released in 1997 (U.S. Fish and Wildlife Service 1997). The species is State listed as endangered in California and as threatened in Oregon and Washington (U.S. Fish and Wildlife Service 1997).
Timber harvest in nesting habitat was the primary reason for listing the species (U.S. Fish and Wildlife Service 1992).

The recovery plan recommends implementing the following short-term actions to stabilize and increase the population: (1) maintain all occupied nesting habitat on Federal lands administered under the Northwest Forest Plan (USDA Forest Service and U.S. Bureau of Land Management 1994); (2) on non-Federal lands, maintain as much occupied habitat as possible and use the Habitat Conservation Planning process to avoid or reduce the loss of this habitat; (3) maintain potential and suitable habitat in large contiguous blocks; (4) maintain and enhance buffer habitat

surrounding occupied habitat; (5) decrease adult and juvenile mortality; and (6) minimize nest disturbances to increase reproductive success. The recovery plan also recommends implementing the following long-term actions to stop population decline and increase population growth: (1) increase the amount and quality of suitable nesting habitat; (2) decrease fragmentation by increasing the size of suitable stands; (3) protect "recruitment" nesting habitat to buffer and enlarge existing stands, reduce fragmentation, and provide replacement habitat for current suitable nesting habitat lost to disturbance events; (4) increase speed of development of new habitat; and (5) improve and develop north/south and east/west distribution of nesting habitat. The recovery plan identifies six Marbled Murrelet Conservation Zones throughout the listed range. The Stuyvesant Spill occurred outside the entrance to Humboldt Bay within Marbled Murrelet Conservation Zone 4 (Zone 4). Zone 4 extends from North Bend, Coos County, Oregon, south to the southern end of Humboldt County, California.

The 2002 population point estimate for Zone 4 is 4,900 Murrelets, with a 95 percent confidence interval of 3,500 to 6,400 Murrelets (Huff *et al.* 2003). Fecundity can either be estimated from juvenile-to-adult ratio data gathered during monitoring at-sea or from individual reproductive histories gathered from radio telemetry work. Current estimates using both techniques suggest that the population in Zone 4 is declining (Beissinger and Peery 2003; Beissinger 1995). The total California population is estimated at 6,450 individuals (Ralph and Miller 1995). The majority of California Murrelets breed in the coastal redwoods of Del Norte and Humboldt Counties. A relatively isolated population of approximately 500 birds breeds in the Santa Cruz Mountains in San Mateo and Santa Cruz Counties of central California (Peery *et al.* 2004). A small number of birds may also nest at scattered locations in Mendocino County (Thomas Hamer, personal communication). In winter, some Marbled Murrelets appear to move away from their breeding areas and can be regularly found along the coast as far south as Pt. Sal (Peery *et al.* 2002).

In addition to loss of nesting habitat due to logging, potential causes of Murrelet decline include nest predation by corvids (ravens, jays) and other predators, oil spills, marine pollution, and

possibly fluctuation in prey availability from oceanographic events (U.S. Fish and Wildlife Service 1997; Nelson 1997). Predation of eggs and chicks by corvids (*e.g.*, ravens, jays) is a major cause of nest failure (Nelson and Hamer 1995). Nelson and Hamer (1995) further predict that even small increases in predation can have deleterious effects to population viability due to the Murrelet's low reproductive rate.

In northern California, availability of nesting habitat is widely thought to be a limiting factor on the Marbled Murrelet population and the primary reason for its decline (see Ralph and Miller 1995 and Miller *et al.* 1997). When logging occurs in nesting habitat, displaced Marbled Murrelets do not "pack" into the remaining good habitat at higher densities (Burger 2001; see also Miller *et al*. 2002). In fact, Marbled Murrelet nesting densities or other standardized observations of nesting birds are remarkably constant within forest types, even after logging of nearby nesting habitat occurs (Burger et al. 2002; Burger and Tillmanns 2002; Conroy *et al*. 2002). When occupied nesting habitat is lost, the population declines. In the long run, the population loses the breeding pairs that utilized the habitat (Burger 2001). In the short run, some of the displaced birds probably attempt to nest elsewhere, although in less preferred locations. Meyer and Miller (2002) report that displaced birds continue to use small forest fragments for several years before abandoning the area. Because these locations are marginal, breeding success is likely lower and the displaced subpopulation fails to sustain itself and is eventually lost after several years (see Miller *et al.* 2002).

4.3.4.1 Injury Quantification

Twenty-four Marbled Murrelets were collected as a result of the spill. The Trustee-RP technical working group estimated total mortality at 135 individuals, implying a 5.6 dead bird multiplier. This is higher than the multiplier calculated for most other birds killed in the spill. As noted above, Marbled Murrelets are small-bodied birds. This makes their carcasses difficult to find for human searchers and easily removed by scavengers. This multiplier is low, however, relative to small-bodied birds in other spills due to the thorough beach search effort conducted following the Stuyvesant spill.

	Collected Alive		Collected	Total	Total
Species	**Released**	**Died**	**Dead**	**Collected**	**Estimated Dead**
Marbled Murrelet	0	4	20	24	135

4.3.4.2 Restoration Alternatives

The table below provides a list of restoration concepts considered by the Trustees.

PROJECT CONCEPTS	**BENEFITS**
Acquisition of old growth/residual habitat at risk of logging	**Marbled Murrelet**
Corvid management programs	**Marbled Murrelet**
Silvi culture of second growth forest to create nesting habitat	Marbled Murrelet
Captive breeding	Marbled Murrelet
Artificial nest platforms	Marbled Murrelet

Captive breeding, silviculture and the use of artificial nests are relatively untested concepts and were therefore not considered by the Trustees to be feasible projects having an adequate likelihood of success. In general, restoration options for Marbled Murrelets are limited by the

lack of information on the survival and reproductive requirements of the species, as well as its unusual life history.

After evaluating these projects using the initial and additional screening criteria, the Trustees identified the remaining two projects as the preferred restoration projects for Murrelet restoration. The first, preservation and management of old growth habitat, will permanently protect from logging, and enhance, murrelet nesting habitat. The second, corvid management, will maintain or increase murrelet nest productivity in the region.

Preservation/Management of Murrelet Habitat

The Trustees considered two different habitat preservation projects: 1) Contribution to the acquisition and management of the Grizzly Creek Marbled Murrelet Conservation Area (MMCA project; Humboldt County); and 2) A conservation easement on old growth parcels and surrounding second growth timber, known as the Miracle Mile Complex, currently owned by Green Diamond Resource Company (Miracle Mile project; Humboldt County).

The Grizzly Creek MMCA was set aside in the 1999 Pacific Lumber Company Habitat Conservation Plan for a period of five years to provide an opportunity for acquisition and permanent protection of the MMCA by the United States and/or the State of California. A portion of the MMCA was acquired by the State in 1999, and in 2003, the California Wildlife Conservation Board (WCB) purchased the remaining 600 acres with the understanding that funds for Marbled Murrelet habitat protection obtained through settlement of the Kure case might be available to replace at least a portion of the WCB funds used for this purchase.[6] The 600 acres includes 328 acres of residual redwood forest and 24 acres of unentered old growth redwood forest.

The Miracle Mile project involves purchase of a conservation easement, in perpetuity, over one of the largest remaining complexes of old growth redwood parcels in Northern California. Under this easement, Green Diamond Resource Company would agree to abstain from harvesting, as well as certain other activities that might disturb nesting murrelets, in the complex of parcels as well as in a surrounding buffer area (second growth forest). Furthermore, Green Diamond Resource Company would agree to management practices (carried out by the Trustees or their representatives) for the enhancement of Marbled Murrelet habitat and reproduction in the surrounding parcels. The old growth parcels are considered to be occupied by Marbled Murrelets and, together, provide approximately 135 acres of unentered old growth redwood forest. A total of 222 acres of surrounding buffer areas would be included in the easement to protect the old growth stands.

[6] The CDFG advised the WCB that any use of recovered funds would be conditioned upon the Trustees' compliance with the Oil Pollution Act's requirement for "adequate public notice, opportunity for a hearing, and consideration of all public comments," prior to finalizing and implementing a restoration plan for the spill. The CDFG also advised the WCB that: 1) any settlement of the Trustees' claims for natural resource damages will be set forth in a judicial consent decree which is also subject to public comment before the court will enter it as a judgment; and 2) the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) apply to the approval of the restoration plan of which projects to address Marbled Murrelet injuries would be a component.

After consideration of public comment regarding, and other factors related to, the alternative projects, the Trustees selected the Miracle Mile project as the preferred restoration project. Rationale for the Trustees' decision included the larger acreage of unentered old growth contained in the Green Diamond parcel, increased cost-effectiveness of the Green Diamond project, and greater threat of harvesting in the Green Diamond parcel versus the MMCA.

Corvid management at Redwood National and State Parks and vicinity
This project would contribute to on-going management efforts to limit anthropogenic food sources that result in unnaturally large corvid (i.e., Steller's Jay, Common Raven, American Crow) populations. In addition, as a form of adaptive management, the possible removal of certain ravens will be evaluated and considered after the project implementation has commenced. The specific method of raven removal and any required permits or environmental compliance will be completed by the implementing agency (Redwood State and National Parks).

Corvids (*i.e.*, ravens and jays) are some of the primary nest predators of Marbled Murrelets (Nelson 1997; Brand and George 2000). Nelson (1997), in discussing Murrelet fecundity in general, notes:

> Predators contribute substantially to nest failure in North America (43% of 32 nests, Nelson and Hammer 1995; 71% of 14 nests, I. Manley pers. comm.). Eggs may be preyed on when nests are neglected for short periods of time or abandoned, or if adult is chased off nest. Adults are vulnerable during incubation and during flights to nests. Chicks may be preyed on anytime during the 27-40 days they are along [*sic*] in the nest.
>
> Avian predators (1) of eggs: include Common Ravens (Corvus corax) and Steller's Jays (Cyanocitta stelleri), (2) of chicks: include Common Ravens, Steller's Jays, and Sharp-shinned Hawks (Accipiter striatus), (3) of adults on nest: include Common Ravens and Sharp-shinned Hawks, and (4) of adults flying in forests: include Peregrine Falcon (Falco peregrinus); Singer et al. 1991, Marks and Naslund 1994, Nelson and Hamer 1995, D. Suddjian pers. comm.).

Raven predation of endangered species is not a new problem. It has been widely documented in the Mojave Desert with respect to the desert tortoise (*Gopherus agassizii*). In that context, a comprehensive program to address anthropogenic food sources that support ravens is being recommended to supplement lethal control efforts (Boarman 2002). The problem of corvid management has also been addressed in a recent statewide Corvid Management Plan, which reviews many potential management options (Liebezeit and George 2002).

The settlement funds allocated for this project total $500,000.

4.3.4.3 Scaling for Primary and Compensatory Restoration

As with the other bird species groups, the Trustees used a REA approach for scaling the appropriate size of a restoration project. Because Marbled Murrelets are a declining species, this REA differed from the others in how lost and gained bird-years were calculated. The Trustees' framework for scaling restoration included: (1) a population model to quantify lost bird-years due to the spill, and (2) a nest model to examine the benefits, in terms of gained bird-years, from protecting nests via land acquisition (see Appendix G for a more detailed description). The injury model was based upon a similar life-cycle as used by Beissinger (1995) and Beissinger and Nur (1997). It incorporated a density dependent mechanism, whereby birds preferentially (but not exclusively) nested in higher quality versus lower quality old-growth habitat. Bird-year loss was

measured by projecting the number of females in the local Murrelet population over the recovery period under injured and uninjured scenarios.

A nest-based model was used to assess the number of highly productive nests that would need to be protected in order to compensate for the injury. A productive nest was defined as one where murrelets were nesting at a "stationary fecundity" (*i.e.*, nest productivity was sufficiently high to offset losses due to natural mortality/survivorship). The benefit of the land acquisition project was assumed to be the difference between the numbers of birds in the population over time as a result of active nests at a highly productive "acquisition site" versus those same birds initially nesting at a much less productive "alternative" site. This simulated murrelets having to find new nesting areas after their current habitat is removed (due to logging).

Because of uncertainty in Marbled Murrelet demographics (*e.g.*, survivorship, fecundity), the trustees examined a wide range of plausible scenarios when scaling restoration. Results suggest that *more than* 13 highly productive nests would need to be protected from imminent logging in order to compensate for the mortality resulting from the spill. The Trustee-RP technical working group agreed that the protection of 12-14 productive nests (where Murrelets were nesting at a "stationary fecundity") would compensate for the spill related acute mortality.

Using optimistic, but reasonable, assumptions regarding the benefits from protecting nests within the Miracle Mile parcels, the Trustees believe that protection, enhancement, and management for the benefit of Marbled Murrelets of these parcels will compensate for the Marbled Murrelet injury. Because there are considerable uncertainties regarding the actual benefits from protecting nests within the parcels (*e.g.*, whether or not 12-14 nests with stationary fecundity exist in the parcels), the Trustees also believe that a contribution to on-going corvid management efforts in the Redwood National and State Parks and vicinity is important for full compensation for injuries to murrelets.

4.3.4.4 Environmental Consequences (Beneficial and Adverse)

Beneficial Effects

The Miracle Mile project will protect nesting Marbled Murrelet habitat and guarantee that it remains in existence primarily for the benefit of Marbled Murrelets in the future. It is known that murrelets nest within the Miracle Mile parcels and that they would not be able to do so if the area were logged.

The corvid management project is intended to improve Marbled Murrelet nest success through a decrease in predation caused by ravens, crows, and jays. Sustaining the Marbled Murrelet population through the next few decades will enable future Murrelets to access increasing amounts of protected old growth forest and second growth forest as it matures into suitable nesting habitat.

Because campgrounds are located near the largest old growth trees, many known nesting stands with the highest Marbled Murrelet activity are near campgrounds. To the extent that the campgrounds serve as source populations for jays and ravens, the project may considerably lower corvid numbers in areas adjacent to the campgrounds as well. Consequently, those Marbled Murrelets beyond the immediate vicinity of the campgrounds may also benefit from the project.

The educational components of the corvid management project will teach the public about imbalances in the ecosystem that may be caused as different species respond positively and negatively to human actions. Specifically, the public will learn how seemingly innocuous interactions with wildlife (e.g., feeding jays at a picnic table) or poor housekeeping at a campsite (e.g., leaving a bag of chips on a table) sustains corvid populations at unnaturally high levels, which in turn can have long-term negative consequences for the Marbled Murrelet. The educational message may carry beyond the campgrounds to local residences and other human gathering places, resulting in increased awareness at those locations as well. From a recreational standpoint, an additional benefit to campers from the corvid management project is enhanced aesthetic appeal of campgrounds due to improved garbage control.

Adverse Effects

With respect to the Miracle Mile project, there are no obvious adverse impacts to wildlife or habitat provided that the habitat is managed according to approved Marbled Murrelet habitat management guidelines.

With regard to the corvid management program, this project will have direct impacts upon both campers at campground and picnic areas and upon corvids and possibly other animals that scavenge food waste at these sites. Campers will be made more aware of existing rules and restrictions upon their food management and may be under the threat of enforcement action should they fail to comply. While corvids and other animals such as raccoons will not be trapped and removed, they will likely experience a reduction in their available food supply. For corvids, this may lead to decreased fledgling survival and lower reproductive success. These adverse impacts are an inevitable part of the transition from artificially (through human activities) elevated population levels to lower, more natural, population levels. Corvids, raccoons, and other animals currently living outside of the campgrounds are not likely to be impacted.

4.3.4.5 Probability of Success

The probability of success of the Miracle Mile project is high. Similar land protection/management projects have been done in the past (e.g., by the Apex Houston Oil Spill Trustee Council) and such lands remain protected and still contain nesting Marbled Murrelets. There is no reason to expect Marbled Murrelets will abandon suitable nesting habitat where there is low disturbance.

The success of the corvid management project relies on several linkages: the link between project tasks and an actual reduction in food waste; the link between a reduction in food waste and an actual reduction in corvid numbers; and the link between a reduction in corvid numbers and an actual reduction in nest predation.

The first two linkages have been demonstrated at other campgrounds dealing with bear problems. For example, daily camper education, constant enforcement, and improved food waste receptacles at Yosemite National Park substantially limit the amount of food available to wildlife. In the Santa Cruz Mountains, corvid density has been correlated with the level of campground occupancy (David Suddjian Biological Consulting, personal communication).

The elevated corvid levels at campgrounds and picnic areas suggest that corvids do depend on human food waste, and thus corvid numbers may be reduced by a reduction in food waste. The final link between corvid numbers and actual nest predation is difficult to measure directly, as Marbled Murrelet nests are difficult to find and study. However, experiments with artificial eggs have found that predation pressure declines with decreasing corvid density (Raphael *et al.* 2002). Thus, the project has a reasonable probability of success.

4.3.4.6 Performance Criteria and Monitoring

These projects will include several years of monitoring. In the Miracle Mile parcels, surveys for Marbled Murrelet presence and their nesting behaviors will be conducted for a period of 20 years. At the locations for the corvid management programs, surveys of corvids, relative to control locations, will be conducted.

4.3.4.7 Evaluation

The Trustees have evaluated these projects against initial and additional screening criteria developed to select restoration projects and concluded that these projects are consistent with the selection factors. The Trustees determined that this type and scale of project would effectively provide appropriate compensation for Marbled Murrelets injured as a result of the Spill and have identified these projects as preferred projects.

4.3.5 Wetland Birds Injury and Restoration

This species group includes a wide variety of birds associated with wetlands or that feed upon fish or marine invertebrates. This broad category was created because relatively low numbers of each species were impacted by the spill, such that restoration for more refined categories would result in very small projects. By combining these species into a single category, the Trustees have identified a restoration project that is both more viable and cost effective.

The majority of these species do not breed in the vicinity of the spill, but are winter visitors to the area. Their nesting grounds are often far to the north or far inland (e.g. boreal lakes for scoters, tundra pools for phalaropes, inland lakes for California and Ring-billed Gulls).

4.3.5.1 Injury Quantification

There were 54 birds collected in this species group. The total estimated dead was 117, implying a total dead-bird multiplier of slightly more than two. The multiplier varies from species to species depending on the size of the bird and the dates and locations, relative to search effort, where they were collected.

	Collected Alive		Collected	Total	Total
Species	**Released**	**Died**	**Dead**	**Collected**	**Estimated Dead**
Great Egret	0	1	0	1	2
White-fronted Goose	0	0	1	1	2
Cackling Goose	0	0	2	2	4
White-winged Scoter	3	3	4	10	16
Surf Scoter	7	2	8	17	27
American Coot	1	0	0	1	2

Red-necked Phalarope	0	0	1	1	3
Red Phalarope	0	0	2	2	5
Ring-billed Gull	0	1	1	2	9
California Gull	0	0	3	3	7
Sabine's Gull	0	0	2	2	10
gull, sp. (small)	0	0	1	1	5
Caspian Tern	0	1	1	2	3
Common Tern	0	0	1	1	1
Unknown	0	0	11	11	21
TOTAL	**11**	**8**	**38**	**57**	**117**

Because population data was not available for every species, lost bird-years were calculated relying on the demographic characteristics of Western Gull (for the gulls) and an average of scoter species for all other birds, as described in Sperduto et al. (1999). See Appendix C for details. Due to the low numbers of birds collected in this species group (except for scoters and gulls), further refinement of this approach would yield little change in the final restoration scaling results. The Trustee-RP technical working group agreed to apply the single-generation stepwise replacement approach to calculating lost bird-years, as described in the Methods section above. Using this approach results in the following estimates:

Species	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Great Egret	2	2.60	5
Gr. White-fronted Goose	2	2.60	5
Cackling Goose	4	2.60	10
White-winged Scoter	16	2.60	42
Surf Scoter	27	2.60	70
American Coot	2	2.60	5
Red-necked Phalarope	3	2.60	8
Red Phalarope	5	2.60	13
Ring-billed Gull	9	4.44	40
California Gull	7	4.44	31
Sabine's Gull	10	4.44	44
gull, sp. (small)	5	4.44	22
Caspian Tern	3	2.60	8
Common Tern	1	2.60	3
Unknown	21	2.60	55
TOTAL	**117**		**361**

These lost bird-years represent the interim losses between the time of the spill and return of these populations to pre-spill conditions. Thus, any restoration project benefiting this species group should seek to replace 361 lost bird-years.

4.3.5.2 Restoration Alternatives

Because these species are associated with wetlands (either directly or indirectly), the Trustees considered a wide variety of project concepts to restore wetlands in the Humboldt Bay area. Many of these projects aim to restore converted pasture lands back to tidally-influenced salt marsh habitat. Additionally, several projects focused directly on certain species of birds. The table below lists all the projects considered.

PROJECT CONCEPT	BENEFITS
Tract 20 acquisition (302 acres of tidelands) for Humboldt NWR – protection from oyster culture	Eelgrass, mudflats, shorebirds
Hunt Ranch acquisition (74 acres of diked ag land) and conversion back to wetlands	Salt marsh, mudflats, shorebirds, wetlands
Eel River Wildlife Area acquisition (up to 3,000 acres of nearby ag land) and conversion to wetlands	Wetlands (brackish, estuary, and freshwater)
Mad River Slough Wildlife Area acquisition (up to 1,000 acres of nearby ag land) and conversion to wetlands	Wetlands (brackish, estuary, and freshwater)
Old Arcata drive-in theatre acquisition (25 acres) and conversion to wetlands	Wetlands (freshwater)
White Slough Field at Humboldt Bay NWR – restore tidal action w/ setback levee	Eelgrass, salt marsh, shorebirds
North Spit eelgrass bed restoration – remove fill on 10 acres	Eelgrass
North Bay eelgrass bed restoration – remove oyster shell debris on 100 acres	Eelgrass
Hookton Slough restoration – move levee to restore tidal action to 140 acres	Salt marsh, mudflat, shorebirds, wetlands, possibly eelgrass
Bayview/Schmidbauer acquisition (290 acres of diked ag land) – restore to wetlands	Salt marsh, mudflat, shorebirds, wetlands, possibly eelgrass
McDaniel Slough restoration – remove tide gate and move levee to restore tidal action	**Saltmarsh, mudflat, shorebirds, wetlands**
Industrial shoreline enhancement – re-establish “natural” shoreline	Shorebirds
Shorebird viewing blinds and signs – s. of Samoa Bridge	Shorebirds, human rec. use
Tide gate improvements – to restore some tidal action to various streams	Fish (Tidewater Goby, Coho Salmon); waterfowl
Table Mountain heron/egret rookery acquisition (4 acres w/ 60 pairs) for Humboldt Bay NWR	Herons, egrets
Promotion of shellfish areas – to establish more shell fish areas	Scoters, waterfowl
On-water seaduck roosting zones – protection from disturbance	Scoters, waterfowl

After evaluating these projects using the initial and additional screening criteria, the Trustees initially identified a contribution toward wetlands restoration at Hookton Slough as a tentative preferred project. However, since the preparation of the draft version of this DARP, the Trustees have identified another preferred project in Humboldt County that will provide resource benefits very similar to those originally anticipated from the Hookton Slough project, but in a more cost-effective and timely manner, and with identified partnering funds. This project is the McDaniel Slough restoration project. Contributing to this project’s cost-effectiveness is the fact that the McDaniel Slough project also benefits the Human Recreational Beach Use injury category discussed in section 4.3.9.

All of the projects except Hookton and McDaniel Slough were originally screened out for various reasons. For example, some of them would have benefited only a single or narrow range of resources whereas the selected project will provide multiple resource and service benefits. In

addition, several would have benefited mostly brackish or freshwater habitats, or eelgrass habitats which were not among those habitats injured by the Spill.

McDaniel Slough Marsh Enhancement Project: The McDaniel Slough Marsh Enhancement Project is described in detail in the Environmental Impact Report prepared by the City of Arcata (City of Arcata 2004). The project is planned for a 240-acre parcel of land located at the southwest corner of the City of Arcata and owned by the State of California and the City of Arcata.

The property consists of Humboldt Bay tidelands that were diked and drained approximately 100 years ago. Because tidal gates at the mouth of McDaniel Slough restrict tidal flow into the area, the existing habitat is a mixture of seasonally wet agricultural fields and a small amount (approximately 6 percent) of riparian habitat or marsh. To restore the tidal connection between Humboldt Bay and 200 acres of the site, the tide gates at McDaniel Slough will be removed to create a breach in the bay-front levee. Portions of existing interior levees along McDaniel Slough would be removed to improve marshplain drainage and habitat transition and new levees would be constructed around the project site perimeter. Approximately 30,000-40,000 cubic yards of suitable excavated soil will be graded onto 20-27 acres of low elevation areas within the project area to build up the marsh plain and accelerate the development of the desirable pickleweed habitat elevation.

See Section 4.3.9.3 for discussion of settlement funds allocated for contribution to this project.

4.3.5.3 Scaling for Primary and Compensatory Restoration

As section 4.3.5.1 described, the total injury to this restoration category was 361 lost bird-years, or 131,853 bird user-days. Because these species use Humboldt Bay wetlands and associated habitats primarily as a winter foraging area and not as a breeding area, restoration scaling could not be based on increased nesting, fecundity, or some related measure of reproductive success. Instead, the scaling was based upon potential bird use, as measured in bird user-days.

Construction of the McDaniel Slough project began in 2005. The EIR predicts rapid colonization of the intertidal area within the project within the first ten years, because the site has suitable elevations for colonization and a nearby source of estuarine sediment. After 50 years, a mature marshplain will develop throughout the area below mean higher high water (City of Arcata 2004). For the purpose of restoration scaling, the Trustees assumed that (1) bird usage will increase gradually to reflect subtle increases in the local population sizes as a result of habitat restoration; and (2) the project will have a 50-year effective life. Combining these assumptions with waterfowl density estimates from DFG surveys in Humboldt Bay, the Trustees calculated that McDaniel Slough would generate 25,378 additional wetland bird user-days per acre of appropriate habitat provided. Assuming that 131,853 wetland bird user-days were lost due to the Spill, a contribution of 5.2 acres to the McDaniel Slough project would be appropriate to compensate for losses to waterfowl.

Additional acres of wetland restoration will be required to compensate for injuries to the water column (see Section 4.3.6) and rocky intertidal habitat (see Section 4.3.7). Appendix H provides additional details regarding the REA for this species group.

4.3.5.4 Environmental Consequences (Beneficial and Adverse)

Beneficial Effects

The McDaniel Slough project will restore 200 acres of salt marsh habitat, creating a mosaic of vegetated habitats, mudflats, tidal sloughs, and other intertidal wetlands. This habitat restoration will benefit a wide variety of birds, including egrets, waterfowl, shorebirds, and other wetland species by providing food, shelter, and nest sites. Some portions of the existing levee that borders the McDaniel Slough/Janes Creek channel will be left in place to serve as roosting islands for birds. The project provides an important linkage between bird habitat on the City's Arcata Marsh Sanctuary and habitat on the Department of Fish and Game's Mad River Slough Wildlife Area. Invertebrate and fish species associated with salt marsh habitats will benefit from the increased amount of aquatic and intertidal habitat. The removal of the tide gates will also permit upstream and downstream migration of anadromous fish. The proposed project includes trails, wildlife viewing structures, benches, and information kiosks that will provide recreational and educational benefits in addition to the ecological benefits provided by the habitat restoration

Adverse Effects

The environmental effects of the project are described in detail in the EIR (City of Arcata 2004), along with mitigation strategies for potential adverse effects. There will be a permanent change in the type of habitat at the site from terrestrial or seasonally wet habitat to tidal wetland habitat, which may adversely affect terrestrial wildlife species. Tidal wetlands will replace freshwater or brackish wetlands. These impacts are mitigated by the large amount of tidal habitat that will be restored and by the creation of 40 acres of brackish and freshwater ponds on the 40 acres of the project area that are not being restored to tidal action.

4.3.5.5 Probability of Success

This project has a high probability of success because it relies on proven techniques. Much of the restoration will occur over time through natural processes as tidal flows return to the area after the tide gates are removed and the levee is breached. The probability of successful restoration to tidal marsh will be increased by placing 30,000-40,000 cubic yards of suitable excavated soil onto 20-27 acres of low elevation areas within the project area to build up the marsh plain. The experience and cooperativeness of the landowners also increase the probability of success, as does the amount of planning that has already taken place in preparation of the EIR.

4.3.5.6 Performance Criteria and Monitoring

This project will include annual monitoring regarding vegetation type and bird use to document the re-creation of salt marsh habitat. Presence of plant and bird species associated with salt marsh will indicate successful restoration.

4.3.5.7 Evaluation

The Trustees have evaluated this project against initial and additional screening criteria developed to select restoration projects and concluded that this project is consistent with these selection factors. The Trustee-RP technical working group determined that this type of project

would effectively provide appropriate compensation for wetlands birds (as defined above) injured as a result of the Spill and have identified this project as a preferred project.

Additionally, as will be described below, the Trustee-RP technical working group determined that this type of project would also provide compensation for water column biota and rocky intertidal habitat injured as a result of the Spill. The total scale of the project reflects compensation for all three categories of injury: wetland birds, water column biota, and rocky intertidal habitat.

4.3.6 Water Column Injury and Restoration

Impacts to water column biota often go undetected during oil spills. In this case, however, a die-off of shrimp (*Thyanoessa spinifera*) was documented in the vicinity of the North and South Spits of Humboldt Bay on September 12, 1999, the 6th day after the spill. This led to a more thorough investigation of potential water column impacts via the use of models that estimate the physical fate of oil in the water.

4.3.6.1 Injury Quantification

Modeling of the physical fate of the oil in the water column, conducted by the Trustee-RP technical working group, revealed that water concentrations of relatively toxic oil constituents (polyaromatic hydrocarbons [PAHs]) were highest in the upper reaches of the water column (near the ocean surface). Based on modeled concentrations, PAH toxicity assessment for aquatic organisms was limited to the upper 2 meters of the water column. The model estimated that 4.6 million (3,282 kg) shrimp, 6000 (121 kg) anchovies and 5 (5 kg) unknown epipelagic fish likely were also killed by the spill.

4.3.6.2 Restoration Alternatives

The Trustees are not aware of restoration alternatives specifically designed for shrimp or anchovies. Thus, the Trustees opted to compensate via out-of-kind restoration, focusing on salt marsh wetlands in Humboldt Bay. The same restoration options considered under the wetland bird injury category (see Section 4.3.5) were considered here. This project for water column injuries would simply be combined with the preferred restoration project identified to address wetland birds as well. See Section 4.3.5.2 for a detailed list of restoration alternatives and a description of the preferred restoration project (*i.e.*, McDaniel Slough Project).

4.3.6.3 Scaling for Primary and Compensatory Restoration

As section 4.3.6.1 described, the total injury to this restoration category was 3,282 kg of shrimp, 121 kg of anchovies and 5 kg of unknown epipelagic fish. In order to scale this injury to an out-of-kind restoration project, the Trustees calculated the injury in terms of lost kg-years of biomass, based upon the size of the animals and their life expectancy. The Trustee-RP technical working group jointly estimated that 2,843 kg-years of biomass were lost due to the spill. Furthermore, upon examination of ecological efficiency parameters, the Trustee-RP technical working group jointly agreed that 357,486 kg of primary production biomass would be necessary to sustain or replace the lost resources.

The biomass production associated with a salt marsh restoration project was then examined. The Trustee-RP technical working group agreed to rely on Rogers (1981), whereby the average Humboldt marsh plant productivity is estimated at 5.22 g(ww)/m^2/year. The Trustees then assumed that a salt marsh restoration project would provide benefits gradually, eventually realizing a goal of 60% of potential (as defined by Rogers 1981) over a period of 12 years and then providing those benefits such that the total life of the project is 100 years. The Trustees calculated that such a project would generate 66.3 kg/m^2. Because 357,486 kg of biomass are required to offset the injury, a total of **5,396 m^2**, or 1.3 acres of salt marsh restoration would be appropriate to compensate for the injury to these water column biota. These acres may be added to the acres calculated for salt marsh restoration to compensate for wetland bird and rocky intertidal injuries.

Appendix I provides additional details regarding the REA for this species group. See Section 4.3.5.4 for environmental consequences of the preferred restoration project for this injury (McDaniel Slough Project).

4.3.7 Rocky Habitat Injury and Restoration

The Rocky Habitat can be categorized into three types, based on substrates and types of services provided: beach/rocky intertidal habitats; cliffs/offshore rocks/artificial habitat (e.g., riprap and jetties); and tide pools. In general, rocky habitats provide shelter and/or foraging for invertebrates, birds, and plants, particularly in the cracks and crevices in the rocks. Harbor snails, kelp, and other invertebrates make up a substantial aspect of the biota in the intertidal rocky habitat outside crevices and pools. The upper intertidal area and areas above the splash zone also provide habitat for plants and invertebrates, as well as important nesting and roosting areas. The tide pools and cracks in the rocks provide shelter to plants and invertebrates, and therefore foraging areas for birds and mammals.

In general, due to the high tidal energy and substrate type of rocky habitats, oil persistence is relatively low compared to sandy beaches, and lower on vertical (cliff) versus platform surfaces. However, rocky habitat contains microhabitats with elevated susceptibility to oiling, such as crevices and tide pools. These areas can trap and hold weathered oil, exposing the rich floral and faunal communities to large accumulations of oil for limited periods.

4.3.7.1 Injury Quantification

An estimated 162 acres of rocky intertidal habitat was exposed to oil. Appendix J provides a full report on the injury assessment and quantification of sandy beach and rocky intertidal habitat injuries. This report was prepared by the Trustee-RP technical working group. The report concludes that 10.4 acre-years (discounted) of rocky intertidal habitat services were lost due to the spill.

4.3.7.2 Restoration Alternatives

Restoration options for rocky intertidal habitat are quite limited. Thus, the Trustees opted to compensate via out-of-kind restoration, focusing on salt marsh wetlands in Humboldt Bay. The same restoration options considered under the previous two injury categories were considered here. This project for rocky intertidal injuries would simply be combined with the preferred restoration projects identified to address those categories. See Section 4.3.5.2 for a detailed list

of restoration alternatives and a description of the preferred restoration project (*i.e.*, McDaniel Slough Project).

4.3.7.3 Scaling for Primary and Compensatory Restoration

Restoration scaling was based upon the quantified injury to rocky intertidal habitat. As section 4.3.7.1 described, the total injury to this restoration category was 10.4 acre-years (discounted) of resource services. For restoration scaling, the Trustees focused on wetland restoration, estimating the increased number of acre-years of resource services that would derive from restored acres of wetland habitat. While out-of-kind, the Trustees directly scaled wetland restoration to rocky intertidal impacts. Efforts to refine this out-of-kind scaling would likely lead to assessment costs that exceed the value of the injury.

Assuming that project benefits begin in the year 2004, ramp up as described in the previous section, and continue for 100 years, the Trustees calculated that such a project would generate 12.3 additional acre-years of services per acre. Because 10.4 acre-years were lost due to the spill, a total of 0.8 acres of salt marsh restoration would be appropriate to compensate for the injury to the rocky intertidal habitat. This part of an acre may be added to the acres calculated for salt marsh restoration to compensate for wetland bird and water column injuries.

Appendix J provides additional details regarding the HEA for this injury category. See Section 4.3.5.4 for environmental consequences of the preferred restoration project for this injury (McDaniel Slough project).

4.3.8 Sandy Beach Habitat and Snowy Plover Injury and Restoration

The sandy beach habitat is host to a wide variety of invertebrates and certain shorebirds (including the Snowy Plover) which feed upon them. These biota may be found in the intertidal zone, the dry sand of the upper beach, or in the wrack (e.g., “seaweed” on the beach).

Prior to the spill, students of Dr. Milton Boyd of Humboldt State University conducted surveys of the invertebrates at Clam Beach. These surveys showed the most abundant phylum sampled was Arthropoda (which included the orders Amphipoda [57.1% of total invertebrates], Mysidacea [20.5%], and Isopoda [13.5%]. The phylum Polychaeta made up 7.2% of their sample.

Because of its richness, expansive area, and shallow nature, Clam Beach is an important feeding area for shorebirds in the Humboldt Bay area. Isopoda, Amphipoda, and Mysidacea are eaten by many shorebirds, including the Snowy Plover. Polychaeta are also a food item for shorebirds as well as for surf perch.

The likelihood of exposure of Isopoda, Amphipoda, and Mysidacea to oil is high. These animals actively feed on the beach face with the incoming or receding tide and would easily be exposed to the oil itself, or a waterborne fraction, through external contact, respiration, and ingestion. Animals would continue to be exposed as stranded oil was lifted from the beach and transported to new locations. Some animals were likely lost to smothering wherever oil stranded on the beach. Polychaeta were probably exposed to some waterborne fraction, but are generally resistant to small amounts of oil. Additionally, the necessary removal of oiled wrack during the

clean-up process decreased the abundance of detritus and decaying organic matter available for shelter and food. This would cause immediate impacts as well as delay recovery.

Adult surf perch feeding in the near shore area would not likely be affected. Effects could have occurred to eggs or larva had the spill occurred during spring months.

The Snowy Plover is a shorebird found along the west coast of North American and at inland alkaline lakes. The Pacific coast population of the Western Snowy Plover was federally listed as threatened on March 5, 1993 (U.S. Fish and Wildlife Service 1993), and reaffirmed April 21, 2006 (U.S. Fish and Wildlife Service 2006). Critical habitat was designated on December 7, 1999 (U.S. Fish and Wildlife Service 1999), and redesignated September 29, 2005, as a result of legal action on the original designation (U.S. Fish and Wildlife Service 2005). The primary threats that warranted listing of the Pacific coast population include loss of nesting sites due to the encroachment of European beachgrass (*Ammophila arenaria*) and urban development; disturbance from human recreational activities; and predation exacerbated by human disturbance (U.S. Fish and Wildlife Service 1993). Recovery objectives in the draft Western Snowy Plover recovery plan (U.S. Fish and Wildlife Service 2001) include: (1) achieving well-distributed increases in numbers and productivity of breeding adult birds, and (2) providing for long-term protection of breeding and wintering plovers and their habitat.

Because Snowy Plovers rarely enter the water and spend most of their time foraging in the wrack or dry sand areas of the beach, they are at less risk from oil spills than some other shorebirds. Nevertheless, Snowy Plovers routinely become oiled as they forage on the beach and in oily wrack and may suffer from oil ingestion, hypothermia, and decreased mobility as a result of oiling.

The area affected by the Stuyvesant spill is located in Snowy Plover federal Recovery Unit 2, which includes Del Norte, Humboldt, and Mendocino Counties, California. The overall management goal for Recovery Unit 2 is 200 breeding adults, including 162 breeding adults in Humboldt County. The Little River/Clam Beach segment, the South Spit/Eel River Wildlife Area segment, and the Eel River gravel bars are the 3 primary breeding areas within Humboldt County, which accounted for all of the nesting in Recovery Unit 2 from 1999 through 2005, with the exception of limited nesting at MacKerricher and Manchester State Parks in Mendocino County during that 6-year period.

The northern California population is quite small (less than 50 pairs), with many of them breeding at Clam Beach (Colwell et al. 2005). R. LeValley reported approximately 49 breeding plovers within Humboldt County in 1999 (LeValley et al. 1999). Sixteen plovers nested from the mouth of the Eel River to the entrance of Humboldt Bay. Fourteen plovers nested on Clam Beach; the beach segment between the Mad River and Little River. The breeding population estimate for Humboldt County in 2005 is 58 plovers, based on color band data. As a comparison, the 2005 breeding season survey detected 32 plovers in Humboldt, suggesting that single-survey efforts underestimate local population size (Colwell et al. 2005, Bart and Earnst 2002). Colwell et al. (2005) reports 4 breeders between the Eel River mouth and the entrance to Humboldt Bay, and 27 breeding plovers from the Mad River to Little River.

4.3.8.1 Injury Quantification

An estimated 3,054 acres (40 linear miles) of sandy beach habitat was exposed to oil. Appendix I provides a full report on the injury assessment and quantification of sandy beach and rocky intertidal habitat injuries. This report was prepared by the Trustee-RP technical working group. The report concludes that 58.6 acre-years (discounted) of sandy beach habitat services were lost due to the spill.

Thirty Snowy Plovers were observed at Clam Beach during the oil spill and observers estimated that 10 of these were visibly oiled. Monitoring efforts by consulting biologists revealed that three of the oiled birds were banded and that two of these individuals died the following winter (Ron LeValley, Mad River Biologists, Inc., personal communication). None were captured for further assessment. Impacts to Snowy Plovers were considered along with the beach habitat injury when designing restoration actions.

4.3.8.2 Restoration Alternatives

Direct restoration of sandy beach invertebrates, which form the prey base of the Snowy Plover, is difficult. However, there are several restoration options that focus on Snowy Plover nesting areas. These include dune restoration to increase nesting habitat, the installation and management of predator exclosures to protect nests, and the protection of nesting and chick-rearing areas from human disturbance (including off-road vehicle traffic). The Trustees considered the projects listed in the following table.

PROJECT CONCEPTS	**BENEFITS**
South Spit of Smith River acquisition and mgmt (57 acres of dune/sand)	Pelicans, gulls, shorebirds, Snowy Plovers
Island Roost at Lake Talawa – building up the island above high water	Pelicans, cormorants, gulls, Snowy Plovers, shorebirds, Aleutian geese
South Spit of Humboldt Bay acquisition (627 acres of dune and salt marsh) – protection from disturbances	Snowy Plover, shorebirds, pelicans, human rec. use
Clam Beach County Park access control project – restrict access to vehicles to protect dune species	Snowy plovers
European beachgrass eradication at up to 4 sites (Eel River WA, 115 acres; Clam Beach, 17 acres; Mad River Co. Pk. 40 acres; Little River State Beach, 53 acres)	**Snowy Plovers**
Human Disturbance Reduction for Snowy Plovers – signs and annual nest protection	**Snowy Plovers**
Anti-predator control (e.g., rats, fox, cats, dogs, etc.)	Snowy Plovers

After evaluating these projects using the initial and additional screening criteria, the Trustees identified a contribution towards dune restoration and Snowy Plover nest protection as a preferred project. The projects which were not selected were screened out for various reasons as follows: 1) South Spit of the Smith River acquisition and Island Roost at Lake Talawa are not as cost effective as the selected projects; 2) South Spit of Humboldt Bay acquisition has already been completed; and 3) the Clam beach County Park Access control and Anti-Predator control projects do not directly increase and protect plover habitat as do the selected projects.

Dune Restoration and Snowy Plover Nest Protection Project: This project would contribute toward dune restoration, including vegetation restoration, as well as toward the maintenance of signs and barriers to protect Snowy Plover nesting areas. Since the 1930's, non-native European beachgrass (*Ammophila arenaria*) has displaced native plant assemblages at dunes along the Humboldt coast, contributing to the decrease or extirpation of native beach and dune species. Implementation of this project will include removal of European beachgrass from infested near-shore dunes and follow-up treatments. Treated dunes will be revegetated with native species typical of the Sand-verbena-beach bursage vegetation series. Also included is an effort to reestablish federally endangered beach layia (Layia carnosa). European beachgrass will re-establish if not re-treated within a few months of the initial removal, so that timely re-treatment (re-removal) of European beachgrass is essential for long term control. Re-treatments should be completed outside of the snowy plover breeding season.

Dune restoration would be accomplished by removing beachgrass, burying it on the backside (easternmost side) of the remaining dune face, and contouring the windward dune face (west side) to a 2-3 percent slope. Additionally, driftwood and other features would be retained to supply cover from predators and wind. Native vegetation would also be retained to the extent practicable. The initial removal of beachgrass will be conducted by using heavy equipment, whereas retreatments will rely on hand pulling. Prior to restoration work, vegetation monitoring will be conducted to ensure special status vegetation is not disturbed during beachgrass removal. A complete rare plant survey will be conducted prior to equipment operation to document and protect any special status species that may occur within the project area. If a special status plant is located, a 7.5 meter equipment exclusion zone will established and the beachgrass will be pulled by hand in that area.

Snowy Plover nest protection measures will include installation of educational signs, symbolic fencing (to provide visual delineation of protected areas) and nest exclosures. Monitoring nesting areas and plover nests will be used to evaluate effectiveness of these and beachgrass eradication measures at enhancing plover fledging success. If monitoring data indicate that snowy plover nesting is not improved by these measures, the Trustees will consider contributing towards the funding of seasonal staff to provide a presence at Clam Beach and assist with public outreach and other plover protection measures.

The settlement funding allocated for this project is $132,000.

4.3.8.3 Scaling for Primary and Compensatory Restoration

Restoration scaling was based upon the quantified injury to sandy beach habitat. As section 4.3.8.1 described, the total injury to this injury category was 58.6 acre-years (discounted) of resource services. For restoration scaling, the Trustee-RP technical working group focused on dune restoration, estimating the increased number of acre-years of resource services that would derive from restored acres of dune habitat. While slightly out-of-kind, the Trustee-RP technical working group directly scaled dune restoration to sandy beach impacts.

Assuming that project benefits begin in the year 2004 and continue for 30 years, the Trustee-RP technical working group calculated that such a project would generate 8.3 additional acre-years of services per acre. Because 58.6 acre-years were lost due to the spill, a total of **7.1 acres** of restoration would be appropriate to compensate for the injury.

Additional funding from other sources may augment the size of this project.

Appendix K provides additional details regarding the HEA for this injury category.

4.3.8.4 Environmental Consequences (Beneficial and Adverse)

Beneficial Effects

This project will both enhance the natural dune habitat and improve nesting habitat for Snowy Plovers. By eliminating non-native vegetation, the process of wind blown sand will restore the dynamic nature of moving sand dune habitat. Habitat restoration will disperse plovers, decreasing nesting density making sites less susceptible to disturbance and predation. By protecting Snowy Plover nesting areas, the birds should experience less disturbance and greater nesting success. This project provides the additional benefit of pro-actively minimizing conflicts between human recreational beach use and nesting plovers. By providing strategically placed protective fencing, the project will focus direct human access to the beach in ways to minimize disturbance to plovers. This project will also benefit native plants as its main focus is removal of competing non-native European beachgrass. The dunes will be revegetated with native species typical of the sand-verbena-beach bursage vegetation series. This project is expected to benefit native vegetation, in particular pink sand verbena (*Ambronia umbellata).* Pink sand verbena is on List 1B of the California Native Plant Society (CNPS) Inventory with a R-E-D (rarity-endangerment-distribution) code of 2-3-2. Beach Layia, a federally endangered species, is not likely to be found in the area but could benefit through the restoration efforts.

Adverse Effects

Because human access will not be allowed inside the Snowy Plover nesting area, a limited portion of the beach will be lost for recreational opportunities during the nesting season. However, these nesting areas are in the foredunes, located high on the beach and well away from the water where most human activity occurs. Human recreational uses are typically minimal in the foredune area; it is primarily used as a transit area to the lower beach. The protective fencing will be placed such that human access from parking areas to the beach will be facilitated, although narrowed to more defined paths.

Another potential adverse effect is the impact of fencing on Snowy Plover nesting. Fencing very small areas immediately around nests may cue predators to nest sites. Fencing with small mesh size may restrict the plovers. This project will incorporate lessons learned from other plover fencing projects to avoid these kinds of pitfalls. Nest exclosures and signing will be installed after mid-April, when merlins (*Falco columbarius*) have migrated out of the area. Merlins are believed to be the main predator on adult Snowy Plovers in Humboldt County.

4.3.8.5 Probability of Success

This project has a high likelihood of success. Both dune restoration projects and protective fencing for Snowy Plovers have been successfully implemented at many sites along the west coast. This project will follow previous successful projects and build on past experience.

4.3.8.6 Performance Criteria and Monitoring

This project will include vegetation monitoring to confirm successful eradication of beachgrass and establishment of native species, and monitoring of plover nesting areas and plover nests. During dune restoration activities, permitted Snowy Plover monitors will survey work areas each day prior to operation and will be present during operational hours to ensure that there are no Snowy Plovers present (within 91 m) and that they have not moved on site. Snowy Plover disturbance reduction measures will be monitored by comparing past breeding successes with the following breeding season's success. Improved dune habitat and successful fledging of Snowy Plover chicks is the goal of the project.

4.3.8.7 Evaluation

This project should result in positive benefits by improving nesting habitat for Snowy Plovers, which were directly impacted by the Spill. The Trustees have evaluated this project against initial and additional screening criteria developed to select restoration projects and concluded that this project is consistent with these selection factors.

4.3.9 Human Recreational Beach Use Losses and Restoration

Several types of recreational activities were impacted by this spill: general beach use (e.g., walking, running, etc.), skilled beach use (e.g., surfing, horseback riding), and offshore boating, (e.g., salmon fishing from private boats). Two types of impacts were considered, lost trips and diminished trips. Lost trips included trips that were not taken as a result of the spill. Diminished trips included trips that were taken, but the value to the visitor was reduced in some way as a result of the spill.

4.3.9.1 Injury Quantification

The table below summarizes the estimated damage to recreational services affected by the *Stuyvesant* oil spill.

Summary of Recreational Losses and Damages.

Location	Activity	Number of Lost Trips	Value per Lost Trip	Number of Diminished Trips	Value per Diminished Trip	Total Value[a]
General Beach Use	Walking	5,547	$20.52	0		$113,825
	Other	557	$20.52	0		$11,437
Skilled Beach Use						
	Surfing	2,111	$25.65	0		$54,140
	Driving	492	$25.65	0		$12,612
	Camping	126	$25.65	0		$3,237
Mad River Beach	General use	197	$20.52	197	$4.10	$4,840
Trinidad Harbor (Boat Launch)	Fishing	135	$54.75	0		$7,368
Trinidad Harbor (Moored Boats)	Fishing	79	$189.07	0		$14,903
Patrick's Point Tidal Pool	Tidal pool viewing	172	$25.65	0		$4,418
TOTAL[a]		**9,415**		**197**		**$226,780**

a. Due to rounding, calculated values may not match presented values.

The majority of the value of human use loss, about $130,000, was due to losses of general beach use activities. These uses made up approximately 67 percent of the number of lost trips and 100 percent of the number of diminished trips. The damage to these activities accounted for about 57 percent of the total recreational damages resulting from the *Stuyvesant* oil spill.

The total estimated damage of $226,780 (in 1998 dollars) approximates the total decrease in the value of recreational services provided by the area that was affected by the spill. The entire period of injury was not directly observed, but was assumed to be roughly three weeks, from September 8 through September 28, 1999. The complete assessment of human use loss is contained in a report developed for the Trustee-RP technical working group (Entrix, Inc. and Industrial Economics, Inc. 2002), available as part of the Administrative Record (see section 3.1.1.4 for information on accessing the Administrative Record).

Because these losses occurred in 1998, the Trustees are adjusting the value to account for inflation and discounting. The recommended approach under the NOAA regulations is to use the U.S. Treasury borrowing rate on marketable securities, as this best reflects the opportunity cost of the money (*Federal Register* 1994, p. 1184). For the relevant time period (adjusting from 1998 to 2007), this rate is approximately 3%. With this adjustment, the lost value (in 2007 dollars) is **$295,896**.

4.3.9.2 Restoration Alternatives

The Trustees considered a variety of projects in Humboldt Bay and along the outer coast. Projects considered provide a range of benefits, including increased beach access, boating and harbor improvements, educational facilities/materials, and enhancements of public use of wildlife areas.

PROJECT CONCEPTS	BENEFITS
South Spit recreational access facilities – complete plan of proposed projects	Human rec. use
Education center for Humboldt Bay NWR – build and maintain	Human rec. use
Interpretive signs at boat launches in Humboldt Bay	Human rec. use/education
Eel River boat ramp – construction of new ramp to replace non-functional one	Human rec. use
Wildlife Area access improvement – at Eel River, Elk River, Fay Slough, and Mad River WAs	Human rec. use
Education center for DFG Wildlife Area – build and maintain	Human rec. use
EcoAtlas of Humboldt Bay watershed – for education	Human rec. use/education
Interpretive displays – at Arcata Marsh, Woodly Is Marina, Elk River WA, others	Human rec. use/education
Palmer's Point Enhancement Project – access improvements, educational aids (interpretive panels) and tide pool study	**Human rec. use/education**
Trinidad Bay/Trinidad Rancheria harbor improvements	Human rec. use/education
McDaniel Slough restoration – remove tide gate and move levee to restore tidal action	**Saltmarsh, mudflat, shorebirds, wetlands**
Ocean foods study – short and long term effects of oil spills on consumers of ocean food resources	Human rec. use/education
Indian Island cleanup and restoration	Human rec. use/education
Humboldt Bay Trails Project– planning, design, and easements	Human rec. use

After evaluating these projects using the initial and additional screening criteria, the Trustees initially identified two tentatively preferred projects: Palmer's Point Enhancement Project and Humboldt Bay Trails Project. However, since the preparation of the draft version of this DARP, the Trustees have become aware of the McDaniel Slough project and believe this project to be more cost-effective (given multiple resource and human use benefits) than the Humboldt Bay Trails Project. The Palmer's Point project was preferred because it is the only project that is designed to directly improve recreational beach use opportunities within the spill impact zone. A contribution to the McDaniel Slough project was also preferred because this project is anticipated to provide significant human recreational use of the Humboldt Bay environment and has partnering funds. The other projects would likely generate less direct human recreational use or were less cost-effective than the preferred projects.

Palmer's Point Enhancement Project: Palmer's Point, located within Patrick's Point State Park, is one of the most popular areas for whale watching, tide pool exploration, and seal and sea lion observation on the North Coast. Many students visit the area to investigate the unique ecosystems in the area. The Palmer's Point Enhancement Project will provide the following:

- Baseline study and assessment of the tide pool area
- A barrier free trail from the parking lot to the viewing area
- Safety enhancing rock work around the viewing area and along the barrier free trail
- Eight interpretive panels in three locations (covering whales, seals and sea lions, sea stacks, sleeper waves, birds, tides-waves-currents-upwelling, intertidal zone biota, tide pool etiquette and safety)
- Two ADA accessible spotting scopes at the viewing areas
- Budget for one time 6 month Park Interpretive Specialist position (CA State Parks)
- Create a tide pool video for use in the Patrick's Point Visitor Center
- Create a brochure explaining the fragility and importance of tide pools

This project will enhance public use and educational benefits of the Palmer's Point area, while protecting the existing habitat for long term public enjoyment. The project is anticipated to provide a high quality outdoor/educational experience for the visiting public and students. The proposed budget for this project is $102,000.

4.3.9.3 Scaling for Primary and Compensatory Restoration

For this injury and restoration category, the Trustees have elected to use the value-to-cost approach to restoration scaling. In this approach, a dollar value is attached to the injury, and that value becomes the damages that are then spent on restoration projects.

Under the NOAA guidelines for damage assessment, the Trustees must first consider and reject the service-to-service (or, implicitly, value-to-value) approach (e.g., REA) before using the value-to-cost approach to restoration scaling (see NOAA 1997, page 4-9). In this case, use of the service-to-service or value-to-value approach would require either the estimation of increased user days over time from the restoration projects and/or an estimate of the value of the project to the public in the future. Given the relatively small size of the recreational use injury, the technical working group concluded that the increased assessment costs required to employ the service-to-service approach could likely exceed the value of the injury. It was concluded that the value-to-cost approach was the most cost-effective and reasonable method to use in this case. Thus, the cost of the restoration projects for human recreational uses shall be approximately **$295,896**. As mentioned above, the contribution to the Palmer's Point Enhancement Project will be approximately $102,000. Accordingly, the balance of approximately $194,000 will be allocated to the McDaniel Slough Project as compensation for this injury category. The total amount of settlement funding allocated to the McDaniel Slough project contribution (*i.e.*, for wetland bird, rocky habitat, water column and human recreational use injury categories) is $250,000.

4.3.9.4 Environmental Consequences (Beneficial and Adverse)

Beneficial Effects

These projects should result in positive benefits by enhancing the quality and amount of public use near the areas affected by the spill. Improvements to public access at Palmer's Point and to the wetland habitat at McDaniel Slough will enhance public enjoyment of natural resources. These improvements will also be implemented in ways that protect and minimize future adverse impacts to habitats subject to frequent human use/visitation. Implementation of these projects will result in improved public education regarding the project areas and will expand appropriate public access to areas that could not formerly be accessed safely or without harm to habitats. See Section 4.3.5.4 for other beneficial effects of the McDaniel Slough project.

Adverse Effects

No significant adverse economic impacts are expected to occur as a result of the Palmer's Point project. Potential environmental impacts will be addressed through the permit process. The improvements brought about by this project will likely result in increased visitation which may result in negative impacts on wildlife due to trampling and other physical disturbance. Such effects can be minimized by careful designation of specific areas for human use. Negative

impacts can also be reduced by fostering adequate public awareness of human disturbance effects on wildlife; feasible mechanisms for increasing awareness include signage and interpretive displays. See Section 4.3.5.4 for discussion of adverse effects of the McDaniel Slough project.

4.3.9.5 Probability of Success

Considering the relatively unimproved condition of the site targeted for improvement, the probability of success for the Palmer's Point project is very high. Palmer's Point will use standard methods for access and education improvements utilized at other state and federal facilities. See Section 4.3.5.4 for discussion of the probability of success of the McDaniel Slough project.

4.3.9.6 Performance Criteria and Monitoring

Performance criteria for these projects will be the completion of the project elements described above. Ongoing maintenance of the new facilities at Palmer's Point will be provided by the California Department of Parks and Recreation. See Section 4.3.5.4 for discussion of performance criteria and monitoring of the McDaniel Slough project.

4.3.9.7 Evaluation

These projects should result in positive benefits by enhancing the quality and amount of public use at Palmer's Point and in Humboldt Bay, which were directly affected by the Spill or are adjacent to affected areas. The Trustees have evaluated these projects against initial and additional screening criteria developed to select restoration projects and concluded that these projects are consistent with these selection factors. The Trustees determined that this type and scale of project would effectively provide appropriate compensation for lost or diminished active human use that occurred as a result of the spill and have identified these projects as preferred projects. See Section 4.3.5.4 for further discussion of the Trustees' evaluation of the McDaniel Slough project.

4.4 "No Action" Alternative

NEPA requires the Trustees to consider a "no action" alternative, and the OPA regulations require consideration of a somewhat equivalent natural recovery option. Under this alternative, the Trustees would take no direct action to restore injured natural resources or compensate for lost services pending natural recovery. Instead, the Trustees would rely on natural processes for recovery of the injured natural resources.

The principal advantages of the natural recovery approach are the ease of implementation and the absence of monetary costs. Natural processes rather than humans determine the trajectory of recovery. However, while natural recovery would occur over time for most of the injured resources, the interim losses suffered would not be compensated under the no action alternative. OPA clearly establishes Trustee responsibility to seek compensation for interim losses pending recovery of natural resources. Losses were, and continue to be, suffered during the period of recovery from this Spill, and technically feasible, cost-effective alternatives exist to compensate for these losses.

4.5 Cumulative Impacts

The Trustees examined a variety of alternatives to restore resources and/or services lost as a result of the Spill. Project specific environmental consequences for each preferred project are provided in Section 4.3. As required by NEPA, this section addresses the potential overall cumulative environmental impacts of implementing this restoration plan.

Cumulative environmental impacts are those combined effects on the quality of the human environment that result from the incremental impact of the alternative when added to other past, present and reasonably foreseeable future actions, regardless of what federal or non-federal agency or person undertakes the other actions (40 CFR 1508.7, 1508.25(a), and 1508.25(c)). Overall, the restoration actions evaluated and planned in the DARP/EA will result in a long term, beneficial impact for birds and wildlife habitat.

Seabirds
The Trustees believe the projects selected in this restoration plan to address the injuries to seabirds, in conjunction with other existing and anticipated seabird restoration projects, including those funded from damage recoveries from other OPA cases, will have a local and regional, long term, moderate, and beneficial impact on seabird populations. The selected projects that benefit seabirds include Protection of Grebe Nesting Colonies on Northern California Lakes, Reading Rock Murre Re-colonization and Protection Project, Acquisition of Old Growth/Residual Habitat at risk of Logging, Pelican Roost Site Protection Project, McDaniel Slough Restoration, European Beachgrass Removal, and Human Disturbance Reduction for Snowy Plovers. All of these projects are designed to have beneficial impacts to seabirds.

Corvids
The Trustees have selected a project that will affect local jay and raven numbers near seabird nesting and roosting sites. The Trustees will provide funding to continue the Corvid Management Project at Redwood National and State Parks. This project includes components for public education and outreach and removing anthropogenic food sources which attract ravens and jays. While not currently planned, the project could include lethally removing a small number of ravens in the future if additional measures are needed to protect nesting marbled murrelets.

A study conducted in the San Francisco Bay Region shows that ravens are more common in urban and suburban environments than in rural areas and have increased dramatically in recent decades (Kelly and Etienne, 2002). Thus, they have not been subject to loss of habitat. Relatively small numbers of ravens have been killed by the U.S. Department of Agriculture's Wildlife Services Program in recent years, but most of this has been done in the Mohave Desert to protect endangered desert tortoises (Boarman 2002). From 2001 to 2004, Wildlife Services killed 185 to 277 ravens in all of California. Ravens are also subject to impacts by West Nile Virus, although no substantial decline has yet been documented.

There are no other known corvid control programs being implemented in the area. In addition the project is focused on a relatively small geographical region around Redwood National and State Parks. On a regional scale, there are various educational programs throughout the state aimed at reducing anthropogenic sources of food at campgrounds for corvids.

Considering the size of the state and the artificially high numbers of corvids at campgrounds, urban and suburban areas, the cumulative impact to corvids from this project is expected to have a minor, local, medium term, negative impact.

Human Use

The Trustees have selected seven projects that may change human use of natural resources. The projects are Protection of Nesting Grebe Colonies at Northern California Lakes; Human Disturbance Reduction for Snowy Plovers; Corvid Management at Redwood National and State Parks; Reading Rock Murre Re-colonization; Pelican Roost Site Protection; McDaniel Slough and Palmer's Point Enhancement Project. Project components include public education and outreach and limiting access to sensitive areas.

The Protection of Grebe Nesting Colonies at Northern California Lakes. This project is an expansion of an existing pilot project to benefit Clark's Grebe nesting colonies. The selected project at Northern California Lakes will involve education and outreach and create a few small exclusion zones, impacting existing regulated waters and activities. These limitations on recreational and other human uses, in conjunction with existing fishing and boating regulations, will have local, medium term, minor impacts.

Corvid Management at Redwood National Park and State Parks: This project will have impact to humans at campgrounds and picnic areas. Humans will be required to manage food more carefully to prevent feeding corvids and other animals. However, there will be some beneficial impacts. The campgrounds should become cleaner and have less litter providing a more aesthetically pleasing environment. In addition, there will be increased educational opportunities for adults and children. The impact to humans will be local, medium term and minor; and also beneficial in regard to the educational component.

Human Disturbance Reduction for Snowy Plovers: This project will be a continuation and possible expansion of an existing project at Clam Beach and Little River State Beach. It is possible that several additional areas will be included beyond Little River State Beach and Clam Beach increasing human access restrictions through symbolic fencing.

Symbolic fencing, a simple, removable, widely spaced, post style fence with a rope across the top, is used to discourage access to plover nesting areas during the breeding season from March 15 to July 15th. When the symbolic fence is in place, access on the beach between waters edge and symbolically fenced areas will be available. Access thoroughfares are also allowed through symbolically fenced areas to the beach. The symbolic fences are removed after breeding season so there are no access restrictions for the bulk of the year. In addition, many other beach areas are available for public use along the coastline. The Trustees expect the cumulative impacts to humans from this project to be local, medium term and minor.

Reading Rock Murre Re-Colonization: There will some minimal impacts to humans from this project. During breeding season buoys will mark closures to boats within 200 feet of the rock. State and Federal agency employees will coordinate to avoid disturbing Common murres during breeding season. The restrictions to recreational boaters around the rock will be small and limited to breeding season. Therefore impacts to humans from this project will be local, medium term and minor.

Pelican Roost Site Protection: There may be some minimal impact to humans from this project. It has potential to restrict access to small areas (e.g. tips of jetties) seasonally. Any potential restrictions will be carefully considered. It also has potential to have a beneficial impact to humans through increased education**.**

McDaniel Slough Wetland Restoration: Cumulative Impacts to humans for this project were evaluated in the McDaniel Slough Wetland Enhancement Project Draft EIR (Draft EIR), dated March, 2006. The Draft EIR summarizes, "the project when viewed cumulatively with other projects, will not have a significant impact." In addition, the project will have a beneficial impact for humans through increased recreational activities including picnicking, wildlife viewing, hiking and education.

Palmer's Point Enhancement Project: is designed to compensate for losses of recreational uses by humans and will provide a beneficial impact through educational and access opportunities.

Overall, four of the selected projects will have local, medium term, minor impacts to humans. In addition, three of the projects will have beneficial impacts to humans including one project which is specifically designed to benefit human recreation. All of the projects will have beneficial impacts to ecosystems of which humans are a part.

Summary

The Trustees believe that, overall, the alternatives selected in this restoration plan, when considered along with past and reasonably foreseeable future projects, will have long term, local and regional beneficial impacts to natural resources; short term, minor, negative impacts to some human recreation; and also beneficial impacts to other human recreation.

5.0 References

Bart, J. and S. Earnst. 2002. Double Sampling to Estimate Density and Population Trends in Birds. *Auk* 119:36-45.

Beissinger, S.R. 1995. Population Trends of the Marbled Murrelet Projected From Demographic Analysis. In *Ecology and Conservation of the Marbled Murrelet.* USDA Forest Service Gen. Tech. Rep. PSW-152. pp. 385-393.

Beissinger, S.R. and N. Nur. 1997. Appendix B: Population Trends of the Marbled Murrelet Projected from Demographic Analysis. In *Marbled Murrelet Recovery Plan.* United States Department of the Interior, Fish and Wildlife Service.

Beissinger, S.R. and M.Z. Peery. 2003. Range-wide Analysis of Juvenile Ratios from Marbled Murrelet Monitoring Programs: Implications for Demographic Analyses. Report submitted to U.S. Fish and Wildlife Service, Arcata, California.

Boarman, W.I. 2002. Reducing Predation by Common Ravens on Desert Tortoises in the Mojave and Colorado Deserts. Bureau of Land Management, U.S. Geological Survey, Western Ecological Research Center. San Diego, California.

Brand, L.A. and T.L. George. 2000. Predation Risks for Nesting Birds in Fragmented Coast Redwood Forest. *Journal of Wildlife Management.* 64(1): 42-51.

Briggs, K.T., and E.W. Chu. 1987. Trophic Relationships and Food Requirements of California Seabirds: Updating Models of Trophic Impact. In J.P. Croxall (ed.) *Seabirds: Feeding Ecology and Role in Marine Ecosystems*. Cambridge University Press, Cambridge. pp. 279-304.

Briggs, K.T., D. G. Ainley, D.R. Carlson, D.B. Lewis, W.B. Tyler, L.B. Spear, and L.A. Ferris. 1987. Final Report: California Seabird Ecology Study. Volume I: Feeding Ecology

Burger, A.E. 2001. Using Radar to Estimate Populations and Assess Habitat Associations of Marbled Murrelets. Journal of Wildlife Management. 65(4):696-715.

Burger, A.E. 2002. Radar Inventory and Watershed-level Habitat Associations of Marbled Murrelets in Clayoquot Sound, 1996-1998 In *Multi-Scale Studies of Populations, Distribution and Habitat Associations of Marbled Murrelets in Clayoquot Sound, British Columbia.* Ministry of Water, Land and Air Protection, Victoria BC. pp. 35-56.

Burger, A.E. and A.R.M. Tillmanns. 2002. Density and spacing of Marbled Murrelets in forest nesting habitat: Evidence of territoriality? Presentation at Pacific Seabird Group 29th Annual Meeting, 20-23 February, 2002, Santa Barbara, CA.

Carter, H.R., Wilson, U.W., Lowe, R.W., Rodway, M.S., Manuwal, D.A., Takekawa, J.E. and Yee, J.L. 2001. Population trends of the Common Murre (*Uria aalge californica*). In Manuwal, D.A., Carter, H.R., Zimmerman, T.S. and Orthmeyer, D.L.(eds) *Biology and Conservation of the Common Murre in California, Oregon, Washington, and British*

Columbia. Volume 1: Natural History and Population Trends. U.S. Geological Survey, Information and Technology Report USGS/BRD/ITR-2000-0012, Washington, D.C. pp. 33-132.

City of Arcata. 2004. McDaniel Slough Draft Environmental Impact Report. Arcata, CA.

Colwell, M.A., Z. Nelson, S. Mullin, C. Wilson, S.E. McAllister, K.G. Ross, and R.R. LeValley. 2005. Final Report: 2005 Snowy Plover Breeding in Coastal Northern California, Recovery Unit 2.

Conroy, C.J., V. Bahn, M.S. Rodway, L. Ainsworth, and D. Newsom. 2002. Estimating Nest Densities for Marbled Murrelets in Three Habitat Suitability Categories in the Ursus Valley, Clayoquot Sound. In *Multi-Scale Studies of Populations, Distribution and Habitat Associations of Marbled Murrelets in Clayoquot Sound, British Columbia*. Ministry of Water, Land and Air Protection, Victoria BC. pp. 121-137.

Entrix, Inc. and Industrial Economics, Inc. 2002. Lost Active Human Use Cooperative Assessment. Report prepared for Bean Dredging, LLC, California Department of Fish - Office of Spill Prevention and Response, California State Lands Commission, U.S. Fish and Wildlife Service. Industrial Economics, Inc., Cambridge, MA.

Ford, R.G., M.L. Bonnell, D.H. Varoujean, G.W. Page, H.R. Carter, B.E. Sharp, D. Heinemann and J.L Casey. 1996. Total direct mortality of seabirds from the *Exxon Valdez* oil spill. American Fisheries Society Symposium 18:684-711.

Ford, R.G., G.W. Page and H.R. Carter. 1987. Estimating mortality of seabirds from oil spills. 1987 Oil Spill Conference Proceedings. Baltimore, MD.

Ford, R.G. and J.C. Ward. 2000. Bird carcass detection rates following the M/V Kure/Humboldt Bay Oil Spill. Final report to the California Department of Fish and Game Office of Spill Prevention and Response, Sacramento, CA.

Gress F, D.W. Anderson. 1983. The California Brown Pelican Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon

Grinnell, J. and A.H. Miller. 1944. *The Distribution of the Birds of California.* Artemisia Press. Lee Vining, CA.

Helvie, J. and R. Lowe. 1985. Environmental assessment update. Proposed land acquisition for Humboldt Bay National Wildlife Refuge, Humboldt County, California. U.S. Fish and Wildlife Service, Region 1, Portland, Oregon.

Huff, M., P. Jodice, J. Baldwin, S. Miller, R. Young, K. Ostrom, C.J. Ralph, M.G.Raphael, C. Strong, C. Thompson, and G. Falxa. 2003. Marbled Murrelet Effectiveness Monitoring, Northwest Forest Plan, 2002 Annual Summary Report (Version 2). U.S. Forest Service, Pacific Northwest Research Station and Pacific Southwest Research Station; Oregon State University; Crescent Coastal Research, Washington Department of Fish and Wildlife. September 2003. 27 pp.

Ivey, G. 2004. Conservation Assessment and Management Plan for Breeding Western and Clark's Grebes in California. Prepared for the American Trader Trustee Council. At: http://www.dfg.ca.gov/ospr/organizational/scientific/nrda/FINAL%20GREBE%20REPORT.pdf.

Jaques, D.L. 1994. Range expansion and roosting ecology of non-breeding brown pelicans. M.S. Thesis. University of California, Davis, California. 49pp.

Jaques, D.L. and D.W. Anderson. 1987. Conservation implications of habitat use and behavior of wintering Brown Pelicans. Unpublished report. UC Davis, PSRDP program. 49pp.

Jaques, D.L. and D.W. Anderson. 1988. Brown pelican use of the Moss Landing Wildlife Management Area: roosting behavior, habitat use, and interactions with humans. Unpublished report, California Department of Fish and Game, Sacramento, California. 58pp.

Jaques, D. L., C. S. Strong, and T. W. Keeney. 1996. Brown Pelican Roosting Patterns and Responses to disturbance at Mugu Lagoon and Other Non-breeding Sites in the Southern California Bight. Unpublished Technical Report No. 54. National Biological Service, Cooperative National Park Services Resources Studies Unit, University of Arizona. Tucson, AZ. 62pp.

Jaques, D.L. and C. Strong. 2002. Disturbance of Brown Pelicans at communal roosts in Southern and Central California. Prepared for the American Trader Trustee Council, California Department of Fish and Game, U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration.

Kelly, J.P. and K.L. Etienne. 2002. Abundance and Distribution of the Common Raven and American Crow in the San Francisco Bay Area, California. *Western Birds* 33:202-217.

Knechtel, H.A., N.M. Jones, M.A. Murphy, A.H. Robinson, K.J. Vickers, G.J. McChesney, M.W. Parker, J. Buffa, H.R. Carter, S.W. Kress, R.T. Golightly, and K.A. Peluso. 2003. Restoration of Common Murre Colonies in Central California: Annual Report 2002. U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex. Newark, CA.

LeValley, R. 1999. Snowy Plover nesting season 1999. Report prepared for Humboldt County Planning Department. Mad River Biologists, McKinleyville, California.

LeValley, R., S. McAllister and A.Transou. 2001. Effects of the Stuyvesant Spill on Reproductive Success of the Western Snowy Plover at Clam Beach, Humboldt County California. Year 2000 season. Draft report submitted to the California Department of Fish and Game - Office of Spill Prevention and Response. Sacramento, CA

Liebezeit, J.R. and T.L. George. 2002. A Summary of Predation by Corvids on Threatened and Endangered Species in California and Management Recommendations to Reduce Corvid Predation. California Department of Fish and Game, Species Conservation and Recovery Program Rpt. 2002-02, Sacramento, CA. 103 pp.

McIntyre, J.W. and J.F. Barr. 1997. Common Loon (*Gavia immer*). In A. Poole and F. Gill (Eds) *The Birds of North America, No. 313*. The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, D.C.

Miller, G.S., S.R. Beissinger, H.R. Carter, B. Csuti, T.E. Hamer, and D.A. Perry. 1997. *Recovery Plan for the Threatened Marbled Murrelet (Brachyramphus marmoratus) in Washing, Oregon, and California*. U.S. Fish and Wildlife Service, Portland, OR.

Miller, S.L., C.B. Meyer, and C.J. Ralph. 2002. Land and seascape patterns associated with Marbled Murrelet abundance offshore. *Waterbirds* 25 (1): 100-108.

Monroe, G.W. 1973. The natural resources of Humboldt Bay, California Department of Fish and Game, Coastal Wetland Ser. 6. 160 pp.

Moskoff, W. 2000. The Impact of Oil Spills on Birds: Looking Back at the *Exxon Valdez. Birding*, Feb. 2000: pp. 44-49.

Nelson, S.K. 1997. Marbled Murrelet (*Brachyramphus marmoratus*). In A. Poole and F. Gill (eds) *The Birds of North America, No. 313*. The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, D.C.

Nelson, S.K. and T.E. Hamer. 1995. Nest success and the effects of predation on Marbled Murrelets. In C.J. Ralph, G.L. Hunt, M.G. Raphael, and J. F. Piatt (eds) *Ecology and Conservation of the Marbled Murrelet.* Gen. Tech. Rept. PSW-GTR-152. Albany, California: Pacific Southwest Experiment Station, Forest Service, U.S. Dept. of Agriculture; 420 pp.

Newman, S.H. and J.A. Mazet. 2001. Post-release survival of Common Murres (Uria aalge) following the Stuyvesant oil spill. Presented at OWCN Research Symposium, May 2001, Sacramento, CA.

NOAA. 1995. Habitat Equivalency Analysis: An Overview. Policy and Technical Paper Series, No. 95-1, (Revised 2000).

NOAA. 1997. Natural Resource Damage Assessment Guidance Document: Scaling Compensatory Restoration Actions (Oil Pollution Act of 1990). NOAA Damage Assessment and Restoration Program, Washington, D.C., December, 1997.

NOAA. 1999. Discounting and the Treatment of Uncertainty in Natural Resource Damage Assessment. NOAA Damage Assessment and Restoration Program, Washington, D.C., February, 1999.

Oka, N. and M. Okuyama. 2000. Nutritional Status of Dead Oiled Rhinoceros Auklets (*Cerorhinca monocerata*) in the Southern Japan Sea. *Marine Pollution Bulletin* 40(4): 340-347.

Peery, Z., et al. 2002. Marbled Murrelet (*Brachyrampus marmoratus*) Demography in Central California: 2001 Progress Report. Prepared for the California Department of Fish and Game, U.S. Fish and Wildlife Service, California State Parks.

Peery, M.Z, S.R. Beissinger, S.H. Newman, E.B. Burkett, T.D. Williams. 2004. Applying the Declining Population Paradigm: Diagnosing Causes of Poor Reproduction in the Marbled Murrelet. *Conservation Biology* 18(4):1088–1098.

Pennycuik, C.J. 1972. Animal flight. The Institute of Biology's Studies in Biology, No. 33. Arnold London.

Ralph, C.J. and S.L. Miller. 1995. Offshore Population Estimates of Marbled Murrelets in California In *Ecology and Conservation of the Marbled Murrelet.* USDA Forest Service Gen. Tech. Rep. PSW-152.1995, p. 353-360.

Raphael, M. G., D. Evans Mack, J. M. Marzluff, and J. M. Luginbuhl. 2002. Effects of forest fragmentation on populations of the Marbled Murrelet. *Studies in Avian Biology* **25**: 221–235.

Rijke, A.M. 1970. Wetability and Phylogenetic Development of Feather Structure in Water Birds. *J. Exp. Biol.* 52: 469-479.

Rogers, J.D. 1981. Net Primary Productivity of *Spartina foliosa, Salicornia virginica, and Distichlis spicata* in Salt Marshes at Humboldt Bay, California. M.A. Thesis, Humboldt State University, Arcata, California. 122pp.

Sharp, B.E. 1996. Post-release Survival of Oiled, Cleaned Seabirds in North America. *Ibis* 138(2): 222-228.

Sperduto, M., C. Hebert, M. Donlan, and S. Thompson. 1999. Injury Quantification and Restoration Scaling for Marine Birds Killed as a Result of the *North Cape* Oil Spill. U.S. Fish and Wildlife Service.

U.S. Forest Service and U.S. Bureau of Land Management. 1994. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-successional and Old-growth Forest Related Species within the Range of the Northern Spotted Owl. Portland, Oregon. Volumes I & II, and Appendices J2 and J3.

U.S. Fish and Wildlife Service. 1992. Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for the Washington, Oregon, and California Population of the Marbled Murrelet. Final rule. Federal Register 57(191): 45328-45337.

U.S. Fish and Wildlife Service. 1993. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Pacific Coast Population of the Western Snowy Plover. Final Rule. Federal Register 58(42):12864-12874.

U.S. Fish and Wildlife Service. 1997. Recovery Plan for the Threatened Marbled Murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California. Portland, Oregon. 203 pp.

U.S. Fish and Wildlife Service. 1999. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Pacific Coast Population of the Western Snowy Plover. Final Rule. Federal Register 64(234): 68508-68544.

U.S. Fish and Wildlife Service. 2001. Western Snowy Plover (*Charadrius alexandrinus nivosus*) Pacific Coast Population Draft Recovery Plan. Portland, Oregon. 630 pp.

U.S. Fish and Wildlife Service. 2005. U.S. Fish and Wildlife Service. 1999. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Pacific Coast Population of the Western Snowy Plover. Federal Register 70(157): 48094-48098.

U.S. Fish and Wildlife Service. 2006. Endangered and Threatened Wildlife and Plants; Proposed Special Rule Pursuant to Section 4(d) of the Endangered Species Act for the Pacific Coast Distinct Population Segment of the Western Snowy Plover Final Rule. Federal Register 71(77):20625-20636.

Wiese, F.K. 2002. Estimation and Impacts of Seabird Mortality from Chronic Marine Oil Pollution off the Coast of Newfoundland. Ph.D. Dissertation. Department of Biology, Memorial University of Newfoundland, St. John's, Newfoundland, Canada.

6.0 Preparers

The following Trustees participated in the development of this DARP:

Steve Hampton
Matt Zafonte
Julie Yamamoto
Katherine Verrue-Slater
California Department of Fish and Game
Office of Spill Prevention and Response
P.O. Box 944209
Sacramento, CA 94244-2090

Daniel Welsh
Charlene Hall
Janet Whitlock
U.S. Fish and Wildlife Service
2800 Cottage Way, W-2605
Sacramento, CA 95825

Charles McKinley
U.S. Department of the Interior
Office of the Solicitor
1111 Jackson Street, Suite 735
Oakland, CA 94607

7.0 Appendices

Appendix A

Listed/Proposed Threatened and Endangered Species for Humboldt and Del Norte Counties (Candidates Included)

TYPE	SCIENTIFIC NAME	COMMON NAME	CATEGORY	CRITICAL HABITAT
Plants				
	Erysimum menziesii	Menzies' wallflower	E	N
	Layia carnosa	beach layia	E	N
	Lilium occidentale	western lily	E	N
	Thlaspi californicum	Kneeland Prairie penny-cress	E	Y
	Arabis macdonaldiana	MacDonald's rock-cress	E	N
Invertebrates				
	Polites Mardon	mardon skipper	C	N
	Speyeria zerene hippolyta	Oregon silverspot butterfly	T	Y
Fish				
	Eucyclogobius newberryi	tidewater goby	E	Y
*	*Oncorhynchus kisutch*	S. OR/N. CA coho salmon	T	Y
*	*Oncorhynchus mykiss*	Northern California steelhead	T	N
*	*Oncorhynchus tshawytscha*	CA coastal chinook salmon	T	N
Reptiles				
*	*Dermochelys coriacea*	leatherback turtle	E	Y
*	*Caretta caretta*	loggerhead turtle	T	N
*	*Chelonia mydas (incl. agassizi)*	green turtle	T	N
*	*Lepidochelys olivacea*	olive (=Pacific) ridley sea turtle	T	N
Birds				
	Coccyzus americanus	Western yellow-billed cuckoo	C	N
	Pelecanus occidentalis californicus	California brown pelican	E	N
	Phoebastris albatrus	short-tailed albatross	E	N
	Strix occidentalis caurina	northern spotted owl	T	Y
	Haliaeetus leucocephalus	bald eagle	T	N
	Charadrius alexandrinus nivosus	western snowy plover	T	Y
	Brachyramphus marmoratus	marbled Murrelet	T	Y
Mammals				
*	*Balaenoptera musculus*	blue whale	E	N
*	*Megaptera novaengliae*	humpback whale	E	N
*	*Balaenoptera physalus*	fin whale	E	N
*	*Balaenoptera borealis*	sei whale	E	N
*	*Physeter macrocephalus*	sperm whale	E	N
*	*Eumetopias jubatus*	Steller (=northern) sea-lion	T	Y
	Martes pennanti pacifica	Pacific fisher	C	N

KEY:
(PE) Proposed Endangered — Proposed in the Federal Register as being in danger of extinction
(PT) Proposed Threatened — Proposed as likely to become endangered within the foreseeable future
(E) Endangered — Listed in the Federal Register as being in danger of extinction
(T) Threatened — Listed as likely to become endangered within the foreseeable future
(C) Candidate — Candidate which may become a proposed species
Critical Habitat — Y = Designated, P = Proposed, N = None Designated

* Denotes a species Listed by the National Marine Fisheries Service

Appendix B

Resource Equivalency Analysis (REA) Method

Background

There are two basic approaches to measuring the compensation for natural resources injuries. One is to focus on the demand side, the "consumer valuation approach"; the other is to focus on the supply side, the "replacement cost" approach. In the former, we seek to measure the monetary value that the public puts on the natural resources (i.e., how much the public demands the services of natural resources); in the latter, we seek to measure how much it costs to replace the natural resource services that the public loses as a result of the injury (i.e., how much it costs to supply natural resource services). See the Glossary for complete definitions of some of the terms used here.

FIGURE 1: Consumer Valuation versus Replacement Cost Approaches for Natural Resource Damage Calculation

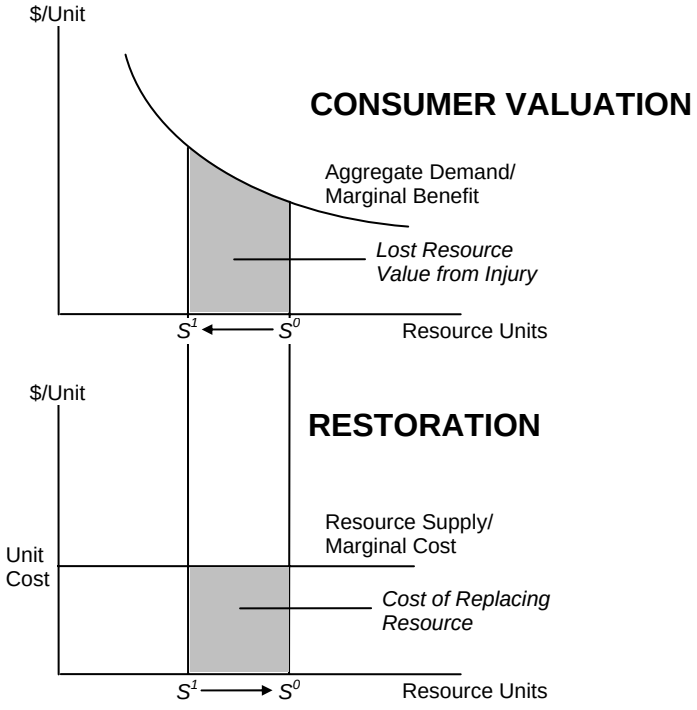


Figure 1 illustrates the difference between these two approaches. In both graphs, the supply of natural resources shifts from S^0 to S^1 as a result of an incident (e.g., oil spill, sediment discharge into a stream, illegal removal of vegetation). The shaded area in the top graph illustrates the dollar value of the resource loss as measured by the monetary payment that would make the public indifferent to the incident. For example, if each individual in a 30 million person society would need a $.05 payment (on average) to make them indifferent to the resource loss, the shaded area in the top graph would equal $1.5 million. Because the difficulty in observing market prices that reveal the level of cash payment that would compensate individuals for resource losses, the quantitative characteristics of the demand curve(s), and consequently the size of the shaded area in the upper graph, are difficult to measure. Contingent Valuation (CV) and

other types of analyses are designed to estimate this dollar value. These methodologies typically involve large surveys and can be costly.

The lower graph illustrates a replacement cost approach. Beyond noting that the injured resource has value, the actual extent to which the public values it is not directly considered. Instead, the determination of adequate compensation depends on the level of natural resource provision (versus monetary payments) that compensates society for what it has lost as a result of the incident. The cost of providing this compensation becomes the estimate of damages. Resource Equivalency Analysis (REA) is the primary methodology for conducting this type of measurement in natural resource damage assessment. It is depicted by a resource supply shift in the lower graph from S^1 back to S^0. The shaded area is the total monetary cost of funding the supply shift. For example, if 2 acres of wetland enhancement are estimated to compensate for an incident that temporarily reduced the service value of 1 acre of wetland habitat, the cost of performing 2 acres of wetland enhancement becomes the estimate of damages.

It is clear from Figure 1 that the public's valuation of the resource (the shaded area in the top graph) is not necessarily equal to the total replacement cost (the shaded area in the bottom graph). This is especially true when unique resources or rare species are involved, as the slope of the aggregate demand curve (top figure) may be much steeper due to resource scarcity. This would result in a much larger monetary payment being necessary to compensate the public. In such a case, the replacement cost approach of REA may result in damages far less than the losses as valued by the public. However, because it is easier and less costly to measure the total replacement cost than the total public value, REA has an advantage over other methods, especially for small to medium-sized incidents with minimal impact on rare species.

Resource Equivalency Analysis

In this assessment, REA has been used to determining compensatory damages. This method is relatively inexpensive and relies primarily on biological information collected in the course of determining natural resource injuries caused by the spill. It is consistent with approaches recommended in the language of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Oil Pollution Act of 1990 (OPA).

REA involves determining the amount of "natural resource services" that the affected resources would have provided had it not been injured, and it equates the quantity of lost services with those created by proposed compensatory restoration projects that would provide similar services. The unit of measure may be acre-years, stream feet-years, or some other metric. The size of the restoration project is scaled to the injury first; the cost of restoration is then calculated after the scaling has been done. The cost of restoring a comparable amount of resources to those lost or injured is the basis for the compensatory damages. In this sense, REA calculates the *replacement cost* of the lost years of natural resource services.

Future years are discounted at 3% per year, consistent with National Oceanic and Atmospheric Administration recommendations for natural resource damage assessments. Discounting of future years is done based on the assumption that present services are more valuable than future services. When it comes to natural resources, the question of whether or not society should value the present more than future is a philosophical question (e.g., one can recall the "greenhouse effect" and the question of how much expense we should incur today to preserve the future). However, the question of how much society actually discounts the value of future natural resources is an empirical one. The 3% figure is currently the standard accepted discount rate for natural resource damage assessments.

REA involves three steps: 1) the debit calculation, 2) the credit calculation, 3) the computation of the costs of restoration. These calculations may be done in a variety of ways, but the most common are to estimate the injury and the restoration benefits in terms of area years of habitat or animal years.

Habitat Example

For example, suppose a 10-acre area is degraded due to an oil spill such that it supplies only 30% of its previous habitat services during the year following the incident. In the second year after the incident, the habitat begins to recover, supplying 90% of its baseline services. By the third year it is fully recovered. In this case, the lost acre years of habitat services would be 70% x 10 acres x 1 year + 10% x 10 acres x 1 year = 8 acre years of habitat services. Figure 2 illustrates this example by showing the recovery path of the habitat over time.

As stated above, future years are discounted at a 3% rate, thus the injuries in the second year count a little less. Incorporating this, 7.97 acre years of habitat services were lost. This difference appears minimal here, but becomes significant (due to compounding) if injuries persist many years into the future.

The credit calculation focuses on the gain in habitat services that result from a restoration project. Creating acre years of habitat services is a function of both area and time. Hypothetically, compensation could involve taking 7.97 acres of land with no habitat value (e.g., a parking lot) and turning it into productive habitat for 1 year. Alternatively, we could achieve compensation by creating 1 acre for 7.97 years. In reality, most restoration projects involve taking previously degraded habitat (at another nearby location) and restoring it over a number of years, and maintaining it into the future.

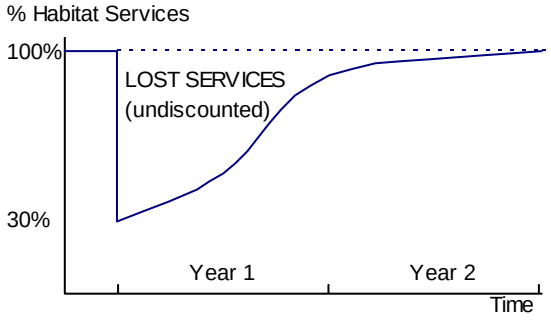


FIGURE 2: Biological Injury and Recovery

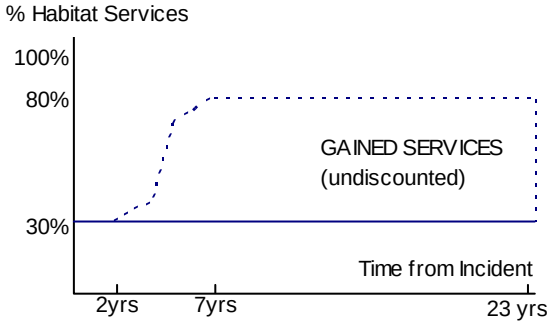


FIGURE 3: Restoration Trajectory/Credit

Suppose the restoration project improves the quality of a nearby degraded area, so that, if it previously provided only 30% of potential services, it would provide 80% of potential habitat services after restoration. Also suppose the project begins two years after the incident and it takes an additional 5 years for the 80% level to be achieved. Figure 3 provides an illustration of this restoration trajectory. In our hypothetical example, the project is expected to have a lifespan of 20 years. Note that, with future years discounted, the 20th year of the project (22-23 years after the incident) counts little; years after that are effectively completely discounted due to uncertainty regarding the future.

Mathematically, we seek to restore an area that will provide 7.97 acre years of services over the discounted 20-year phased-in life span of the restoration project. In this example, that would be

an area of about 1.3 acres. That is to say, restoration of 1.3 acres for 20 years would compensate the public for the 7.96 lost acre years of habitat services due to the spill. Visually, the area identified in Figure 3 (multiplied by the affected acres and calculated to measure the present discounted value) should equal the area identified in Figure 4 (again, multiplied by the acres targeted for restoration and calculated to measure the present discounted value, thus discounting future years).

The percentage of habitat services lost (or gained, in the case of the restoration project) may be measured in a variety of ways. For our hypothetical oil spill case, three examples might include (1) the use of a habitat-wide evaluation index, (2) the use of one or more surrogate species, or (3) the use of an estimate based on the degree of oiling. Care must be taken when using a surrogate species to represent the entire affected habitat. Ideally, this surrogate is the population of one or more species that is immobile (that is, the animals do not move easily in and out of the affected area) and that has significant forward and/or backward ecological links to other species in the affected ecosystem. For example, the population of red crossbills, a bird that feeds primarily on pine cone seeds and migrates erratically from year to year, would be a poor surrogate for measuring injuries to a streambed. The aquatic macroinvertebrate community within the stream, however, provides an ideal surrogate, as they play a key role in the streambed food chain. Likewise, on the restoration side, care must taken when the project targets one or a few species rather than the entire habitat. Ideally, a project that seeks to restore the population of a key indicator species will also benefit the entire habitat and, thus, other species as well. Indeed, such projects typically focus directly on habitat improvements. However, it is important to verify that such a species-centered project is indeed benefiting the entire habitat.

Animal Example

When the injury is primarily to individual animals rather than a complete habitat, the REA may focus on lost animal-years. For example, suppose an oil spill causes negligible injury to a body of water, but results in the death of 100 ducks. Using information about the life history of the ducks (e.g., annual survival rate, average life expectancy, average fledging rate, etc.), we can estimate the "lost duck years" due to the spill. On the credit side, we can examine restoration projects designed to create duck nesting habitat and scale the size of the project such that it creates as many duck years as were lost in the incident.

Restoration Costs = Natural Resource Damages

Once the proposed restoration projects are scaled such that they will provide services equal to those lost due to the incident, the cost of the projects can be calculated. Note that this is the first time dollar figures enter the REA process. Until now, all the calculations of the "equivalency" have been in terms of years of resource services. The cost of the restoration projects is the compensatory damage of the incident.

Prepared by:

Steve Hampton, Ph.D.
Matthew Zafonte, Ph.D.
California Department of Fish and Game
Revision Date: January 14, 2003

For another explanation of the REA methodology (in its more specific form for habitats), see "Habitat Equivalency Analysis: An Overview", prepared by NOAA. Copies of this document are available at http://www.darp.noaa.gov/publicat.htm

GLOSSARY

Aggregate demand

the demand of all consumers combined; e.g., if there are 20,000 people in a town and each person demands two pieces of bread each day, the aggregate demand is 40,000 pieces of bread per day.

Compensatory restoration

a restoration project which seeks to compensate the public for temporal or permanent injuries to natural resources; e.g., if a marsh is injured by an oil spill and recovers slowly over ten years, a compensatory project (which may be off site) seeks to compensate the public for the ten years of diminished natural resources.

Discount rate

the rate at which the future is discounted, i.e., the rate at which the future does not count as much as the present; e.g., a dollar a year from now is worth less than a dollar today; if the bank offers a 3% rate, whereby $1.00 becomes $1.03 in one year, the future was discounted at 3%.

Primary restoration

a restoration project which seeks to help an injured area recover more quickly from an injury; e.g., if a marsh is injured by an oil spill and would recover slowly over ten years if left alone, a primary restoration project might seek to speed the recovery time of the marsh and achieve full recovery after five years.

Replacement cost

the cost of replacing that which was lost; e.g., if fifty acre-years of habitat services were lost due to an oil spill, the cost of creating fifty acre-years of similar habitat services would be the replacement cost.

Appendix C

Demographic Parameters for Calculation of Lost Bird-Years

TABLE 1: Potential Proxy Species for Bird Injury Calculations

Bird Category	Species Suffering Mortality from Stuyvesant Spill	Potential Source of Demographic Parameters
Grebes	Western Grebe Eared Grebe Pie-billed Grebe Unknown Grebe	*North Cape* Grebe
Loons	Common Loon Red-throated Loon	*North Cape* Loon
Non-Marbled Murrelet Alcids	Tufted Puffin Rhinocerous Auklet Cassin's Auklet Pigeon Gillemot Common Murre	Common Murre
Gulls	Glaucous-winged Gull Western Gull California Gull Ring-billed Gull Sabine's Gull Unknown Gull	Western Gull
Procellarids	Laysan Albatross Northern Fulmar Pink-footed Shearwater Sooty Shearwater Buller's Shearwater	Northern Fulmar
Cormorants	Double-crested Cormorant Brandt's Cormorant Pelagic Cormorant Unknown Cormorant	Double-crested Cormorant
Pelicans	Brown Pelican	Brown Pelican
Waterfowl and Wetland birds	White-winged Scoter Surf Scoter Greater White-fronted Goose Cackling Goose Caspian Tern Common Tern Great Egret American Coot Red Phalarope Red-necked Phalarope	*North Cape* Scoter

In the past, Trustees have compiled demographic information and calibrated injury models for various bird families. Several are listed in Table 1 next to species with documented mortality from the Stuyvesant spill. The demographic parameters for each specie group/family presented below have been calibrated to be consistent with a population that is roughly stationary in numbers (i.e., non-declining or non-increasing). The extent to which this sort of calibration is reasonable depends on both the specie being considered and the application of the modeling.

General Grebe
The North Cape REA (Sperduto et al, 1999) calculates injury to grebes by averaging demographic estimates for a variety of grebe species. The following set of roughly stationary demographic parameters is based upon their analysis:

- *Age of First Breeding: 2* Years Old
- *Female Offspring per Adult Female (Annual):* 0.91
- *Survivorship (From fledge to one year of age): 60*%
- *Annual Survivorship (Age 1+): 64.*7%
- *Maximum Age:* 24 Years Old

The only difference between these parameters and those used by Sperduto et al (1999) is that annual survivorship beyond the first year has been increased 2.7%. This calibrates the life history to a population that maintains an approximately constant population size.

General Loon
The North Cape REA (Sperduto et al, 1999) calculates injuries to loons based upon common loon demographics. The following set of roughly stationary demographic parameters is based upon their analysis:

- *Age of First Breeding:* 5 Years Old
- *Female Offspring per Female (Annual):* 0.27
- *Survivorship (From fledge to one year of age):* 76%
- *Survivorship (Age 1+):* 88.5%
- *Maximum Age:* 24 Years Old

The only difference between these parameters and those used by Sperduto et al (1999) is that annual survivorship beyond the first year has been increased 0.5%. As with the grebe calibration, this adjusts the implied loon life history to maintain an approximately constant population size.

Western Gull
Nur et al (1994) create a population model for western gull at the Farallon Islands. The following parameters draw from their analysis:

- *Age of First Breeding:* 3 Years Old
- *Male Offspring per Male (Age 3):* 0.012
- *Male Offspring per Male (Age 4):* 0.152
- *Male Offspring per Male (Age 5):* 0.457
- *Male Offspring per Male (Age 6):* 0.660
- *Male Offspring per Male (Age 7):* 0.695
- *Male Offspring per Male (Age 8):* 0.765
- *Male Offspring per Male (Age 9):* 0.785
- *Male Offspring per Male (Age 10):* 0.750
- *Male Offspring per Male (Age 11):* 0.710

- *Male Offspring per Male (Age 12 and 13):* 0.725
- *Male Offspring per Male (Age 14):* 0.705
- *Male Offspring per Male (Age 15):* 0.660
- *Male Offspring per Male (Age 16+):* 0.610
- *Survivorship (From fledge to one year of age):* 60%
- *Annual Survivorship (Age 1-2):* 75%
- *Annual Survivorship (Age 2-3): 82%*
- *Annual Survivorship (Age 3-4 to 6-7): 84%*
- *Annual Survivorship (Age 7-8 and 8-9): 83%*
- *Annual Survivorship (Age 9-10 and 10-11): 82%*
- *Annual Survivorship (Age 11-12): 81%*
- *Annual Survivorship (Age 12-13 to 14-15): 80%*
- *Annual Survivorship (Age 15-16 and 16-17): 78%*
- *Annual Survivorship (Age 17-18):* 75%
- *Annual Survivorship (Age 18-19): 67%*
- *Annual Survivorship (Age 19-20): 57%*
- *Annual Survivorship (Age 20-21): 50%*
- *Maximum Age:* 21 Years Old

The Nur et al (1994) model tracks males in the population (assuming a 1:1 sex ratio).[1] The difference between the above parameters and those used by Nur et al (1994) is that the survivorship from fledge to one year of age has been increased 4.5% to calibrate the model to approximate stationarity. This 60% survivorship from fledge to Age 1 is still within the range considered by Nur et al (1994).

Northern Fulmar

We use Northern Fulmar demographics as the basis for calculating injury to procellarids. Northern Fulmar may be longer lived than other procellarids injured in the spill. As a result, using Northern Fulmar demographics as a proxy for procellarid injury has the potential for over-estimating bird-year loss for the entire procellarid family.

The following northern fulmar demographic parameters have been calibrated to imply a roughly constant population size:

- *Age of First Breeding:* 5 Years Old
- *Female Offspring per Female (Age 5): 0.013*
- *Female Offspring per Female (Age 6): 0.026*
- *Female Offspring per Female (Age 7): 0.039*
- *Female Offspring per Female (Age 8): 0.053*
- *Female Offspring per Female (Age 9): 0.066*
- *Female Offspring per Female (Age 10): 0.079*
- *Female Offspring per Female (Age 11): 0.092*
- *Female Offspring per Female (Age 12): 0.105*
- *Female Offspring per Female (Age 13): 0.118*
- *Female Offspring per Female (Age 14): 0.131*
- *Female Offspring per Female (Age 15): 0.144*

[1] Male western gulls are perceived to be the limiting factor in western gull population growth (Nur et al 1994, Pierotti and Annet 1995). During the 1970s, some western gull populations displayed male-female sex ratios close to 2:3, presumably due to the feminization of male embryos from DDT (Pierotti and Annet 1995). Since that time sex ratios have returned to "near equity" (Pierotti and Annet 1995).

- *Female Offspring per Female (Age 16): 0.158*
- *Female Offspring per Female (Age 17): 0.171*
- *Female Offspring per Female (Age 18): 0.184*
- *Female Offspring per Female (Age 19): 0.197*
- *Female Offspring per Female (Age 20+): 0.21*
- *Annual Survivorship (Age 69-70):* 6.9%
- *Annual Survivorship (Age 68-69):* 16.9%
- *Annual Survivorship (Age 67-68):* 26.9%
- *Annual Survivorship (Age 66-67):* 36.9%
- *Annual Survivorship (Age 65-66):* 46.9%
- *Annual Survivorship (Age 64-65):* 56.9%
- *Annual Survivorship (Age 63-64):* 66.9%
- *Annual Survivorship (Age 62-63):* 76.9%
- *Annual Survivorship (Age 61-62):* 86.9%
- *Annual Survivorship (Age 5-6 to 60-61):* 96.9%
- *Annual Survivorship (Age 4-5):* 89.6%
- *Annual Survivorship (Age 3-4):* 82.4%
- *Annual Survivorship (Age 2-3):* 75.1%
- *Annual Survivorship (Age 1-2):* 67.9%
- *Survivorship (From fledge to one year of age):* 60.6%
- *Maximum Age:* 70 Years

A review by Hatch and Nettleship (1998) provides the basis for these choices. Their summary includes the following information specific to deriving demographic model parameters specific to northern fulmar:[2]

- *Age of First Breeding:* Dunnet (1992) notes first evidence of breeding northern fulmars at five years of age.
- *Female Offspring per Female (Ages 20+):* Hatch and Nettleship (1998) present unpublished data by Nettleship that show the proportion of fulmar pairs that produce a fledgling ranged from 37.2 - 46.9% in three "good" years, and 5.4 % in one "bad" year. If we assume (1) the productivity is at the midpoint of the range in good years (0.4205) and (2) a one-to-one sex ratio, then the full productivity of northern fulmars is (.4205)(.5) = 0.21025,
- *Female Offspring per Female (Age 5-19):* Dunnet (1992) finds evidence that first breeding in northern fulmars occurs when the birds are between five and twenty years of age. We assume that the productive capacity of northern fulmar increases linearly such that it is 6.25% in Year 5, 12.5% in Year 6, etc. until 100% are breeding in Year 20.
- *Annual Survivorship (Age 5-6 to 60-61):* Hatch (1987b) estimates average annual survival rates of northern fulmar at 96.9%.
- *Maximum Age:* With a constant 96.9% adult survivorship it is reasonable for some northern fulmar to live a very long time (greater than 80 years). Evidence of there long-lived life history was found in Scotland where several birds banded in 1951 were still breeding in 1990 at ages likely to be greater than 50 years old (Dunnet 1991). For the purpose of this analysis, we chose a maximum age of 70. Because of our belief that the adult survivorship will decline as a bird reaches the older age classes, we assume that, starting at Age 61, survivorship decreases 10% per year until it reaches zero at 70 years old.

[2] The below citations are cited as referenced in Hatch and Nettleship (1998). They are not cited as primary sources.

To calibrate the model, we assumed that the survivorship from Ages 0-1 to 4-5 increased linearly each year such that 96.9% adult survivorship was achieved at Age 5-6. We then calibrated Age 0-1 survivorship so that the sequence was consistent with a population maintaining a constant population size.

Double-Crested Cormorant

The following double-crested cormorant demographic parameters have been calibrated to imply a roughly constant population size:

- *Female Offspring per Female (Age 1):* 0.028
- *Female Offspring per Female (Age 2):* 0.12
- *Female Offspring per Female (Age 3):* 0.58
- *Female Offspring per Female (Age 4+):* 0.54
- *Survivorship (From fledge to one year of age):* 48%
- *Annual Survivorship (Age 1-2):* 74%
- *Annual Survivorship (Age 2+):* 83.2%
- *Maximum Age:* 24 Years

A review by Hatch and Weseloh (1999) provides the basis for these parameter choices.[3] Their summary includes the following information specific to deriving demographic model parameters specific to double-crested cormorants:

- *Female Fledges per Female (Age 1).* Observations by van der Veen (1973) suggest that 4.7% of females first bred at Age 1. Hatch and Weseloh's (1999) summary of numerous studies suggest that each double-crested cormorant nest produces between 1.2-2.4 fledges per nest. If we assume the low end of that range (which we use to calibrate demographic information) and a one-to-one sex ratio, then each Age 1 female produces (.047)(1.2)(.50) = 0.028 fledging females on average.
- *Female Fledges per Female (Age 2).* Observations by van der Veen (1973) suggest that 16.5% of females first breed at Age 2. If we assume that 90% of past breeders nest, a one-to-one sex ratio, and 1.2 fledges per nest, then Age 2 each female produces (.165)(1.2)(.50) + (.047)(1.2)(.50)(.9) = 0.12 fledging females on average.
- *Female Fledges per Female (Age 3).* Observations by van der Veen (1973) suggest that 78.8% of females first breed at Age 3. If we assume that 90% of past breeders nest, a one-to-one sex ratio and 1.2 fledges per nest, than each Age 3 female produces (.788)(1.2)(.50) + (.212)(1.2)(.50)(.9) = 0.59 fledging female on average.
- *Female Fledges per Female (Age 4+).* Observations by van der Veen (1973) suggest that all Age 4 and later females have already breed once. If we assume that 90% of past breeders nest, a one-to-one sex ratio and 1.2 fledges per nest, then each Age 4+ female produces (1.2)(.50)(.9) = 0.54 fledging female on average.
- *Survivorship (From fledge to one year of age).* van der Veen (1973) estimates Age 0 survival at 48%.

[3] The below citations are cited as referenced in Hatch and Weseloh (1999). They are not cited as primary sources.

- *Annual Survivorship (Age 1).* van der Veen (1973) estimates Age 1 survival at 74%.
- *Annual Survivorship (Age 2+).* van der Veen (1973) estimates Age 1 survival at 85%. We chose the slightly lower value of 83.2% to calibrate the model to a population that was maintaining constant numbers over time.
- *Maximum Age.* Klimkiewicz and Futcher (1989) note that the oldest banded bird in 5,589 encounters was 17 years 9 months old. We choose a maximum age of 24 because that is the oldest age that at least 1% of the cormorants will reach given the demographic assumptions presented above.

Overall, choosing low range values for (1) *Age 2+ Survivorship* and (2) *Fledges per Nest* calibrates the model.

Brown Pelicans

Demographic information on brown pelicans was compiled by the California Office of Environmental Health Hazard Assessment and summarized in the Cal/Ecotox online database (http://www.oehha.org/cal_ecotox/default.htm). The Cal/Ecotox database (and the research papers cited therein) provides the primary data source for the below potential parameter choices:

- *Age of First Breeding:* 3 Years Old
- *Female Offspring per Adult Female:* 0.33
- *Annual Survivorship (Age 3+):* 88%
- *Annual Survivorship (Age 2-3):* 80%
- *Annual Survivorship (Age 1-2):* 72%
- *Survivorship (From fledge to one year of age):* 64%
- *Maximum Age:* 34 Years

These are based upon the following citations from the Cal/Ecotox database.[4]

- *Age of First Breeding:* Lovett and Joanen (1974) note that the age of first nesting is at three years old.
- *Female Offspring per Adult Female:* Anderson et al. (1982) examine six years of data and find 0.18-0.88 fledglings per nest on West Anacapa Island (California) and 0.23-1.20 fledglings per nest on Isla Coronado Norte (California). If we assume (1) a midpoint of the overall 0.18-1.20 fledglings per nest range (0.69), (2) a one-to-one sex ratio, and (3) 95% adults breeding each year, then we get (0.69)(0.5)(.95) = 0.33 female offspring per adult female.
- *Annual Survivorship (Age 3+):* Anderson et al. (1996) find that sixteen of seventeen brown pelicans (94%) from 1986 and 1990 survived 180 days. If we extrapolate to a full year, we find that this is equivalent to approximately an 88% annual adult survival rate.

To calibrate the model, we assumed that the survivorship from Ages 0-2 increased linearly each year such that 88% adult survivorship was achieved at Age 3. We then calibrated Age 0 survivorship so that the sequence of Age 0 to Age 3 survivorship rates is consistent with a population maintaining a constant population size. We choose a maximum age of 34 because that is the oldest age that at least 1% of the brown pelicans would reach given the survivorship assumptions presented above.

[4] The below citations are cited as referenced in the Cal/Ecotox database. They are not cited as primary sources.

Common Murre
Nur et al (1994) created a common murre demographic model for the Farallon Islands. The following parameters are based upon their work, but have been calibrated to imply a roughly constant population size:

- *Age of First Breeding:* 5 Years Old
- *Female Offspring per Female (Age 5):* 0.126
- *Female Offspring per Female (Age 6):* 0.310
- *Female Offspring per Female (Age 7):* 0.405
- *Female Offspring per Female (Age 8+):* 0.420
- *Survivorship (From fledge to one year of age):* 40%
- *Annual Survivorship (Age 1-2):* 80%
- *Annual Survivorship (Age 2-3):* 87%
- *Annual Survivorship (Age 3+):* 91.6%
- *Maximum Age:* 35 Years

The difference between these parameters and those used by Nur et al (1994) is that annual survivorship beyond the first year has been decreased 1.7%.

General Scoter
The Noth Cape REA (Sperduto et al, 1999) calculates injury to scoters by combining demographic information for both surf scoters and black scoters. For the purpose of settlement, we suggest drawing on their parameters for calculating injuries for waterfowl/wetland birds. Specifically:

- *Age of First Breeding: 2* Years Old
- *Female Offspring per Adult Female (Annual): 1.2025*
- *Survivorship (From fledge to one year of age): 37*%
- *Annual Survivorship (Age 1+): 69.375*%
- *Maximum Age:* 15 Years Old

The difference between these parameters and those used by Sperduto et al (1999) is that fecundity and survivorship parameters have been decreased by 7.5% of the *North Cape REA* values (1.3, 40%, 75%) to calibrate the life history parameters to be consistent with a constant population size.

REFERENCES

Hatch, Jeremy J. and D.V. Weseloh (1999). Double-crested Cormorant. The Birds of North America, No.441.

Hatch, Scott A. and David N. Nettleship (1998). Northern Fulmar. The Birds of North America, No. 361.

Nur, Nadav, R.Glenn Ford, and David G. Ainley (1994). Final Report: Computer Model of Farallon Seabird Populations. Point Reyes Bird Observatory.

Pierotti, Raymond J. and Cynthia A. Annett (1995). Western Gull. The Birds of North America, No. 174.

Sperduto, Molly, Charles Hebert, Michael Donlan, and Sarah Thompson. "Injury Quantification and Restoration Scaling for Marine Birds Killed as a Result of the *North Cape* Oil Spill". March 25, 1999.

Appendix D

Loon/Grebe REA Details

INJURY CALCULATION

Species	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Red-throated Loon	7	7.22	50
Common Loon	38	7.22	274
Pied-billed Grebe	1	2.78	3
Eared Grebe	6	2.78	17
Western Grebe	24	2.78	67
grebe, sp.	1	2.78	3
TOTAL	**77**		**414**

See Appendix C for derivation of bird-year multipliers.

CREDIT CALCULATION (projected restoration benefits)

Year	Nests Protected	Increased Fledges	Increased Bird-Years	Discounted to 1998
2003	940	278	750	592
		Based on 1.82 fledges per nest.	Based on 2.70 bird-years per fledge (life expectancy of a fledge)	Discounted at 3% per year
			Total:	**592**

Contribution toward one year of the project would provide sufficient compensation.

Appendix E

Cormorant/Gull/Pelican REA Details

INJURY CALCULATION

Species	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Brown Pelican	3	6.20	19
Brandt's Cormorant	23	4.44	102
Double-cr. Cormorant	25	4.44	111
Pelagic Cormorant	8	4.44	36
cormorant, sp.	4	4.44	18
Western Gull	52	4.50	234
Glaucous-winged Gull	6	4.50	27
gull, sp. (large)	18	4.50	81
TOTAL	**139**		**627**

See Appendix C for derivation of bird-year multipliers.

CREDIT CALCULATION (projected restoration benefits *per nest*)

Year	Increased Fledges	Increased Bird-Years	Discounted to 1998
2006	0	0	0
2007	0.78	2.50	1.9
2008	0.78	2.50	1.9
2009	0.78	2.50	1.8
2010	0.78	2.50	1.8
2011	0.78	2.50	1.7
2012	0.78	2.50	1.7
2013	0.78	2.50	1.6
2014	0.78	2.50	1.6
2015	0.78	2.50	1.5
2016	0.78	2.50	1.5
2017	0.78	2.50	1.4
Continues to 2057.	Based on 0.78 fledges per nest.	Based on 3.2 bird-years per fledge (life expectancy of a fledge)	Discounted at 3% per year
		Total:	**51**

Number of nests needed for project would be 627/51 = **12**.

Appendix F

Murre REA Details

INJURY CALCULATION

Species	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Laysan Albatross	2	12.7	25
Northern Fulmar	10	12.7	127
Pink-footed Shearwater	3	12.7	38
Buller's Shearwater	10	12.7	127
Sooty Shearwater	27	12.7	343
Common Murre	1,600	7.2	11,488
Pigeon Guillemot	74	7.2	531
Cassin's Auklet	60	7.2	431
Rhinoceros Auklet	150	7.2	1,077
Tufted Puffin	1	7.2	7
TOTAL	**1,937**		**14,194**

See Appendix C for derivation of bird-year multipliers.

CREDIT CALCULATION (projected restoration benefits)

Year	Increased Nests	Increased Fledges	Increased Bird-Years	Discounted to 1998
2006	0	0	0	0
2007	6	5	18	14
2008	9	7	27	20
2009	13	10	39	28
2010	70	54	211	148
2011	98	75	296	201
2012	106	81	320	211
2013	110	84	332	213
2014	115	88	347	216
2015	123	94	371	225
2016	132	101	397	233
2017	141	108	425	242
Continues to 2107	Continues at 7% annual growth until maximum at 1,800 nests.	Based on 0.7663 fledges per nest.	Based on 3.938 bird-years per fledge (life expectancy of a fledge)	Discounted at 3% per year
			Total:	**49,184**

Note: First six years of nest numbers and fledges per nest based on data from Devil's Slide Rock Murre Re-colonization Project.

Contribution toward similar project would be 14,194/49,184 = **29%**.

Appendix G

Marbled Murrelet REA Details

INJURY CALCULATION

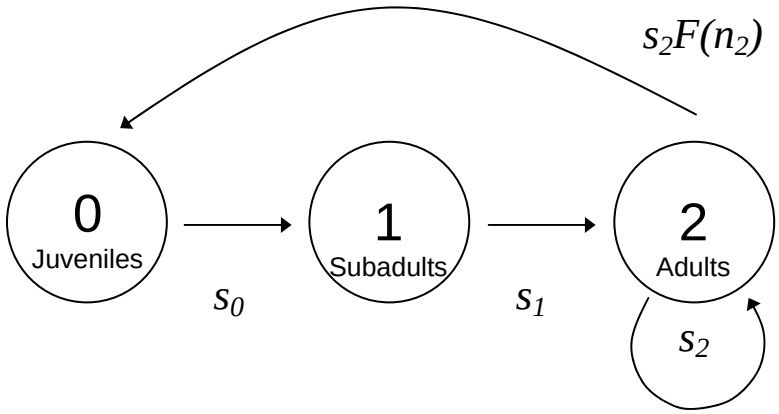
The Trustees calculated the injury based upon female bird-years, assuming a 1:1 sex ratio. This implies that a 135 bird acute mortality translates into an immediate loss of 67.5 female birds from the local population. We used 67 females for our injury modeling.

The discounted bird-year injury (or debit, D) was based upon the following formula:

$$D = \sum_{t=1999}^{2099} \frac{N_{BI,t} - N_{I,t}}{(1+d)^{t-1999}} \qquad (1)$$

Here, $N_{BI,t}$ is the numbers of female birds in the subpopulation in period t had the spill not occurred, and $N_{I,t}$ is the number of female birds in the subpopulation at period t after the spill. For example, if we assume that the size of the injured population was 2100 females at the time of the spill and 67 females were killed, then $N_{BI,1999} = 2100$ and $N_{I,1999} = 2100 - 67 = 2033$. The parameter d is the discount rate. This is set at $d = 0.03$, consistent with federal NRDA guidance for a risk-free discount rate.

To calculate the trajectories $\{N_{BI,t}\}$and $\{N_{I,t}\}$, we use the following re-parameterization of the Beissinger (1995) model.



(2)

The parameters s_0, s_1, and s_2 are the survivorships for juveniles, subadults and adults, respectively. The term $s_2F(n_2)$ reflects the "post-breeding" census convention (i.e., bird-years are counted in the Fall). This implies that adult Murrelets (n_2) must survive (s_2) before they are able to attempt successful breeding ($F(n_2)$). In the model, fecundity increases as the population becomes smaller (i.e., $dF(n_2)/dn_2 < 0$). This reflects the possibility that, as a population declines, it will tend to decline faster in more marginal areas leaving the remaining birds in higher quality habitat.

Combining the trajectories projected from (2) into Equation (1) yields our injury estimate of lost bird-years.

CREDIT CALCULATION (projected restoration benefits)

The overall benefit of the land acquisition and management is scaled based upon the benefit of the project at an individual nest (in discounted female bird-years). The number of nests that need to be protected to compensate for the injury ($N_{Acquire}$) is based upon: (1) the size of the bird-year injury; and (2) the benefit of land acquisition to nesting birds and their offspring (in discounted female bird-years). This is written as:

$$N_{Acquire} = \frac{D}{B_{nest}} \qquad (3)$$

where D is the marbled Murrelet injury from (1) (measured in discounted female bird-years), and B_{Nest} is the benefit of the project per nest affected (in discounted female bird-years per nest).

The benefits per nest (B_{Nest}) are calculated over a 100 year period after logging, according to the formula:

$$B_{Nest} = \sum_{t=t_{\log}}^{t_{\log}+100} \frac{N_{R,t} - N_{BR,t}}{(1+d)^{t-1999}} \qquad (2)$$

Here, $N_{R,t}$ is the expected numbers of female birds supported by a nest within an acquired site at time t.[1] $N_{BR,t}$ depicts the fate of the birds supported by the acquisition site at time t after logging. t_{log} is the number of years between spill and logging without the acquisition project. The parameter d is the discount rate, which is set at 0.03.

The trajectories for $N_{BR,t}$ and $N_{R,t}$ are based upon the same basic modeling framework as used in the injury calculation. However, there are two main differences between the calculation performed here and the calculation used in the injury model. First, the model is applied at the "nest" scale, versus a local population scale. This implies that we follow the number of birds associated with a given nest (versus the entire local female MAMU population). Second, we assume that: (a) with acquisition, nests are sufficiently productive to maintain population levels ($\lambda = 1.0$); and (b) without acquisition, associated birds will reproduce at lower fecundity ($\lambda < 1.0$) after logging occurs ($t_{log} = 2007$).

[1] This would include one adult female per nest, along with corresponding sub-adults, juveniles, and potentially non-breeding adults.

Appendix H

Wetland Birds REA Details

INJURY CALCULATION

Species	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Great Egret	2	2.60	5
Gr. White-fronted Goose	2	2.60	5
Cackling Goose	4	2.60	10
White-winged Scoter	16	2.60	42
Surf Scoter	27	2.60	70
American Coot	2	2.60	5
Red-necked Phalarope	3	2.60	8
Red Phalarope	5	2.60	13
Ring-billed Gull	9	4.44	40
California Gull	7	4.44	31
Sabine's Gull	10	4.44	44
gull, sp. (small)	5	4.44	22
Caspian Tern	3	2.60	8
Common Tern	1	2.60	3
unknown	21	2.60	55
TOTAL	**117**		**361**

See Appendix B for derivation of bird-year multipliers.
Total lost bird-days = 361 bird-years x 365 days = **131,853**

CREDIT CALCULATION (projected restoration benefits *per acre*)

Year	Increased Bird-User Days/Year	Discounted to 1998	Year	Increased Bird-User Days/Year	Discounted to 1998
2006	0	0	2015	782	473
2007	87	67	2016	869	510
2008	174	129	2017	956	545
2009	261	188	2018	1,042	577
2010	347	244	2019	1,129	607
2011	434	296	2020	1,216	635
2012	521	345	2021	1,241	629
2013	608	390	2022	1,241	610
2014	695	433	2023	1,241	593
Continued on next three columns ↗			Continues to 2107	Based on year-round average of 3.4 birds per acre per day	Discounted at 3% per year
				Total:	**25,378**

Note: Average of 3.4 birds per acre derived from a conservative estimate using DFG waterfowl surveys in Humboldt Bay. Note that winter density is much greater than summer density. This estimate reflects a year-round average. Gradual phase-in is meant to reflect gradual increases in populations, as well as the gradual improvement in the restored habitat.

Number of acres needed for project would be 131,853/25,378 = **5.2 acres**.

Appendix I

Water Column to Wetlands REA Details

INJURY CALCULATION

species	mortality	kg/animal	animal-year multiplier	lost kg-years (discounted)	ecological efficiency	kg of biomass needed
unknown epipelagic fish	5	1	0.8333	4	0.0016	2,604
shrimp	4,600,000	0.0007143	0.8333	2,738	0.008	342,250
epipelagic anchovy	6,000	0.0201667	0.8333	101	0.008	12,625
			Based on life expectancy of average age individual	Note: no discounting was used because life expectancy is less than one year		
				TOTAL:	**2,843**	**357,486**

CREDIT CALCULATION (projected restoration benefits *per square meter*)

Year	% of Potential Marsh Productivity	Annual Production (kg/m^2)	Discounted to 1998
2006	0%	0.00	0.00
2007	5%	0.26	0.20
2008	10%	0.52	0.39
2009	15%	0.78	0.57
2010	20%	1.04	0.73
2011	25%	1.31	0.89
2012	30%	1.57	1.04
2013	35%	1.83	1.17
2014	40%	2.09	1.30
2015	45%	2.35	1.42
2016	50%	2.61	1.53
2017	55%	2.87	1.64
2018	60%	3.13	1.73
2019	60%	3.13	1.68
2020	60%	3.13	1.63
2021	60%	3.13	1.59
Continues to 2107.		Based on a potential maximum benefit of 5.22 kg/m^2	Discounted at 3% per year
		Total:	**66.3**

Number of sq. meters needed for project would be 357,846/66.3 = **5,396 m^2 = 1.3 acres**.

Appendix J

Habitat Injury Assessment Report

WORKING DRAFT

HABITAT INJURY ASSESSMENT REPORT
DREDGE STUYVESANT OIL SPILL
HUMBOLDT COUNTY, CALIFORNIA

Prepared for:

BEAN DREDGING, LLC
1055 St. Charles Ave., Suite 500
New Orleans, LA 70130

Prepared by:

ENTRIX, INC.
590 Ygnacio Valley Road, Suite 200
Walnut Creek, California 94596

U.S. Fish and Wildlife Service
Sacramento, CA
California Department of Fish and Game
Office of Spill Prevention and Response
Sacramento, CA
California State Lands Commission
Long Beach, CA

Project No. 376501

April 2001

Page

Page

This Habitat Injury Assessment Report serves to document the injury assessment process conducted cooperatively between the trustees and the representatives for the responsible party to the Dredge *M/V Stuyvesant* oil spill. This assessment process has been conducted by members of the Stuyvesant Technical Group. The trustees were represented by individuals from the U.S. Fish and Wildlife Service, California Department of Fish and Game, and California State Lands Commission. The responsible party was represented by individuals from ENTRIX, Inc.

This report will ultimately include four Chapters. Chapter 1.0 includes the Introduction and brief background of the spill, Chapter 2.0 the Shoreline Injury Assessment, Chapter 3.0 the Water Column Injury Assessment, and Chapter 4.0 the Shoreline and Water Column Credit Analysis. Chapters 1.0 and 2.0 are presented herein. Chapters 3.0 and 4.0 will be prepared seperately as the assessment work is completed.

1.1 SPILL SCENARIO

On September 6, 1999, the Dredge *M/V Stuyvesant* spilled approximately 2,000 gallons of Intermediate Fuel Oil 180 (IFO-180) into the Pacific Ocean off Humboldt Bay, near Eureka, California. The incident occurred when a dredge arm on the *M/V Stuyvesant* punctured one of its fuel tanks. The spill occurred on an outgoing tide and was not contained. Overflights identified oil slicks and tarballs in the ocean as far north as Patrick's Point, with the majority of the oil washing ashore between the North Spit and Trinidad Head (Figure 1-1). Shoreline Clean-up and Assessment Teams (SCAT) were mobilized on September 7, 1999 and conducted surveys daily through September 15. Beach sign-off surveys were conducted between September 14 and September 18, 1999, though selected sites were revisited November 30, 1999. From the time of the release, the oil was at sea for three days before it was observed on shore, as documented on the SCAT forms starting September 9, 1999.

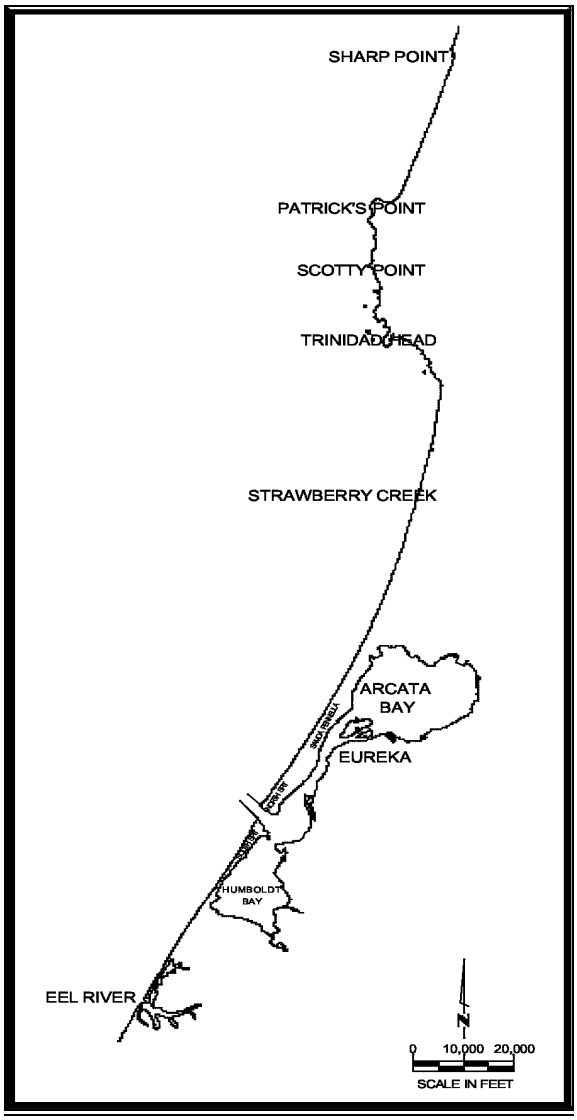


Figure 1-1. Stuyvesant Spill Area

This chapter of the Habitat Injury Report focuses on the injury assessment for the shoreline habitats. The approach used for the shoreline injury assessment is discussed first. A description of the habitats (i.e., natural resources) and ecological services provided by those habitats, the degree of injury to these services, the considerations for the kinds of recoveries of these services, and finally, a summary of the service losses are also presented in this chapter. This report does not address active human use services of those habitats. Recreation use services are covered in a separate report prepared for this damage assessment.

2.1 APPROACH FOR ASSESSING SHORELINE INJURY

The Stuyvesant oil spill caused injury to the services provided by the shoreline habitats in the spill area. To evaluate the magnitude of these injuries and to determine the appropriate level of compensation for these lost services, the Stuyvesant Technical Group employed the Habitat Equivalency Analysis (HEA) model. Through the HEA process, the ecological services provided by each of the shoreline habitats and the subsequent injury sustained by the Spill were used to scale the size and determine the types of restorations projects needed for compensation.

HEA focuses on the ecological services provided by the affected habitats. The first step of HEA is to identify the services that the affected habitat would have provided had it not been injured. Second, the amount of service reduction caused by the oil spill is estimated over time. The input parameters needed for this model were the percent of services lost, acres of injured habitat, and duration of recovery for those service. The sum of service losses over time is called a HEA "debit." Next, the amount of service gain that will be produced by the restoration project(s) is determined, which gives a HEA "credit" per acre of restoration project. Finally, dividing the debit by the credit per acre of restoration project results in the acres of restoration project needed to compensate for the injuries. A detailed description of the HEA methodology can be found in Appendix A.

2.2 DIVISION OF HABITATS

Pursuant to the Cooperative Natural Resource Damage Assessment Agreement, Exhibit A, Task 5, and as an integral component to the HEA process, the Technical Group documented the types of shoreline habitats present in the spill area. For purposes of this assessment, the spill area was defined as the shoreline between Sharps Point to the north and Eel River to the south. Based on the U.S. Geologic Survey Environmental Sensitivity Index maps, 16 different shoreline habitats were identified. To streamline the HEA process, the technical group agreed that the shoreline habitats would be grouped into four categories of habitats, which provide similar types of services.

The shoreline habitats were grouped into two main categories: Beaches, and Rocky Habitat. The Beach category includes sand, gravel, and cobble beaches. The Rocky Habitat, however, was divided into three sub-categories based on substrates and types of services provided. The combination beach/rocky intertidal are habitats consisting of a beach backed with a rocky substrate so that on a lower tide a beach is exposed and at a higher tide only rocky substrate is exposed. These rocky intertidal areas provided service flows from both the beach and the rocky components of the habitat. The cliffs/offshore rocks/artificial habitat (e.g., riprap and jetties) were grouped together as the services of the vertical hard rock surfaces, regardless of origin or location, would provide similar services. The tidepools, though the substrate is similar to the hard rock surfaces of the cliffs, provides a unique habitat and service flow.

2.3 SERVICES AND TYPES OF INJURY FOR EACH HABITAT

This section addresses the first two steps of the HEA process. The first step is to identify the services that the affected habitat would have provided had it not been injured. The second step is to identify the types of injuries these services sustained as a result of the spill.

2.3.1 LIST OF SERVICES PROVIDED

Generally, the services provided by the shoreline habitats include habitat for invertebrates, birds, and plants; nesting and roosting for birds; food services and shelter; and marine mammal haul out. Each habitat grouping provided the above types of services to a unique set of organisms in varying quantities and qualities.

For the beaches, the intertidal sands in the beaches served have habitat for aquatic invertebrates. The lower beaches between the dunes and the high tide line were mainly used by birds for nesting and roosting. The wrack and debris found on the beaches provided food and shelter for terrestrial invertebrates and in turn food for birds. Marine mammals were observed using the gravel and cobble beaches for resting.

For the rocky habitats, during the lower tides, the rocky intertidal area provided similar services to the beaches. Otherwise the rocky habitats provided habitat for invertebrates, birds, and plants, particularly in the cracks and crevices in the rocks. The harbor snails, kelp, other invertebrates make up a substantial aspect of the biota in an intertidal rocky habitat outside the crevices and pools. The upper intertidal area and above the splash zones also provided some habitat for plants and invertebrates, but more likely provided nesting and roosting services. The tidepools and cracks in the rocks provided shelter to plants and invertebrates, and therefore food services to birds and mammals.

2.3.2 TYPES OF INJURIES SUSTAINED

The injuries sustained by shoreline habitats were presented in terms of reduction in quantity and/or decrease in quality of services provided by each habitat. The provision of habitat for invertebrates, birds and plants was reduced by the organisms being smothered by the oil, the cleanup crews trampling habitat during the response effort, and the removal

of oiled plants and sand. The nesting and roosting services were reduced by disturbance to the birds by cleanup crews and increased vehicular traffic, and avoidance of the oiled areas. The quantity of food services were diminished by a potential mortality of prey or plants items, by avoidance of the oiled area by either the foraging organism or prey item, and the fouling and removal of vegetation and debris. The oiling of edible food tissue reduced the quality of the food items.

2.4 ESTIMATION OF INJURY

The magnitude of injury to the services provided by the shoreline habitats is based on the degree, extent, and duration of oiling. The degree of oiling was based on the density of oil stranded on the shore. The location and acreage of the observed oil and length of time the oil remains on the shore represent the extent and duration of oiling, respectively. The technical group developed the various methodologies for estimating the degree, extent, and duration of oiling and the overall shoreline acreage. These parameters were derived from a refinement and/or extrapolation from the available response data listed below.

The technical group reviewed data collected during the response as part of Tasks 1 and 2 in Exhibit A of the Cooperative Assessment. The source of data used to estimate degree, extent, and duration of oiling included, but was not limited to SCAT reports, wildlife reconnaissance reports, field notes and photographs, NOAA overflight maps, aerial photographs, additional field surveys, institutional knowledge from local scientists, tide data from NOAA, and other available data.

The beach habitat sustained three types of injury related to stranded oil, moving oil, and wrack-line oil. On a receding tide, the oil stranded on the beach with each wave, leaving the oil in place on the shore until the next incoming tide. This type of injury was represented by the stranded oil injury. The estimation of the stranded oil acreage was based on the band of stranded oil observed on the beach. However, as oil washed ashore with an incoming tide, the oil moved across the beaches with each wave. As each wave receded, the oil stranded momentarily. With the next wave, the oil re-suspended and moved to another location on the beach. The injury caused by this oiling scenario was represented by the moving oil injury. The moving oil acreage was calculated by subtracting the stranded oil acreage from the total intertidal or "wetted zone" acreage. As limited field data was available about the location, oiling, and removal of wrack material on the beaches, it was assumed that wrack material was present on all beaches and that its degree of injury was proportional to the corresponding degree of stranded oil.

For the rocky habitats, the injuries to the different types of habitats are included in the overall percent loss of services. Therefore, injured rocky habitat acres are for the entire rocky habitat intertidal area including splash zones.

Many beaches were surveyed by SCAT teams multiple times during the response leading to documentation of varying degrees of oiling. Based on the weight of evidence from the SCAT data, the technical group derived one consensus level of oiling. To be conservative, a process was developed for characterizing and quantifying the oiling that represented the heaviest density and acreage of observed stranded oil for each area with multiple SCAT
data. Typically, a beach segment observed to have a considerably larger

band of oiling at a higher density was selected. This degree of oiling was then applied to all injury types within that beach segment.

2.4.1 DEGREE OF OILING

The degree of oiling was categorized using the SCAT classifications. These classifications represent the percent of oiling present in bands of oil observed on the beaches. The SCAT forms indicated four categories of oiling observed during response, which are described below in Table 2-1. The highest degree of oiling observed during the response was the Broken category or 51 to 90% coverage.

SCAT Categories	Percent Coverage for Category
Broken	51% to 90%
Patchy	11% to 50%
Sporadic	1% to 10%
Trace	Less than 1%

Table 2-1. Degree of Oiling Categories

Most beaches were accessible to the SCAT teams during the response. The degree of oiling categorization of these beach segments was based on direct observations documented on the SCAT forms. For inaccessible beaches, the degree of oiling was extrapolated from the nearest surveyed beaches. The beaches were observed to have oiling in all four categories listed above. The rocky habitats, however, were largely inaccessible to SCAT teams, and oiling of the rocks was difficult see. Therefore, the degree of oiling for the rocky habitats was extrapolated from the surrounding beach categories. The rocky habitats north of Trinidad Head were assumed to have "sporadic" oiling, and the rocky habitats south of Trinidad Head were assumed to have "patchy" oiling.

2.4.2 EXTENT OF OILING

Once each segment of shoreline was assigned a degree of oiling described above, the next step was to estimated the acres or extent for each injury type: stranded oil, moving oil, and wrack for the beaches, and the rocky habitats.

The acreage of stranded oil was estimated based on the dimensions of the band of oil observed and noted on the SCAT forms. Each band of oil on the beach was observed to have a percent of oil coverage or degree of oiling as described in the above section. The acres within each oiling category were summed to obtain a total acreage of stranded oil within each category.

For this assessment it was assumed that wrack material was stranded on all the beaches at a constant width. The acreage for the wrack line was estimated for each segment defined above, by assuming that the wrack line width was five (5) feet wide and extended the full length of the defined segment.

The next step undertaken was to determine the acreage of moving oil. This was calculated by subtracting the stranded oil and wrack acreage within each beach segment from the intertidal zone (i.e., wetted zone) acreage for that segment. The width of the wetted zone was defined as the area of the beach from the lowest tide to the highest tide observed during the response period. The width varies for each segment depending on the slope of the beach. The wetted zone acres were determined by estimating the length and width of each segment using GIS, aerial photographs, additional field survey, institutional knowledge from local scientists, tide data from NOAA, and other available data. A summary of the acres for each injury type and oiling category is provided in Table 2-2.

Oiling Category	Stranded (acres)	Moving (acres)	Wrack (acres)	Total Wetted Zone (acres)
BROKEN	48	785	3	836
PATCHY	17	115	1	133
SPORADIC	29	268	2	299
TRACE	37	1739	11	1787

Table 2-2. Beach Habitat Acres

The rocky habitat contains microhabitats, such as crevices, tidepools, and rock faces. Although the crevices and pools can trap weathered oil, the rock surface areas and faces, between the crevices and pools, have little ability to gather floating residuals and thus would be less likely to suffer impacts to service flows from the weathered residuals. These areas of crevices and pools, where residual solids may collect, do not affect the service flows from the rock surfaces. For the HEA evaluation, the impacts to the different service flows are taken into account in the overall percent loss of services. Therefore, rocky habitat acres are for the entire rocky habitat intertidal area including splash zones. A summary of the acres for each combination of oiling category and habitat is provided in Table 2-3.

Habitats	Oiling Category	Acres
tidepools - north	SPORADIC	25
rocky intertidal/combo north	SPORADIC	70
rocky intertidal/combo south	PATCHY	10
cliff north w/ offshore rocks	SPORADIC	30
cliff south w/ riprap & offshore rocks	PATCHY	27

Table 2-3. Rocky Habitat Acres

2.4.3 DURATION OF OILING

For the purposes of the HEA evaluation, the duration of oiling began on the first day the oil was observed on the shore and ended when the beach signoff forms were completed for the affected beaches. The oil came ashore on the third day after the release, September 9, 1999 and the beach forms were signed off on approximately September 16, 1999. Therefore, the duration of the oiling was considered to be 7 days.

2.5 DEVELOPMENT OF RECOVERY CURVES

For each habitat type and degree of oiling, a recovery curve was developed to calculate the total loss of services, or HEA debit. For the beach habitats, the moving oil injured the services differently than the stranded oil. Therefore, separate recovery curves were developed for both of these types of injury for the beach habitats. The type of injury to the wrack line is similar to the injuries of the stranded oil, therefore, wrack line acres and services losses are grouped with the stranded oil.

The factors influencing the curve inflections and duration are discussed below.

2.5.1 TYPES OF INJURIES AND RECOVERIES FOR EACH INFLECTION OF CURVE

The recovery curves vary depending on the services affected, the nature of the oiling, cleanup efforts, and other factors. For the Stuyvesant HEA, there were three general phases of recovery: initial injury, post-response recovery, and long term recovery (Figure 2-1). The duration of each phase of the recovery curve was influenced by the degree of oiling. The greater the degree of oiling, the longer the recovery time.

General Recovery Curve

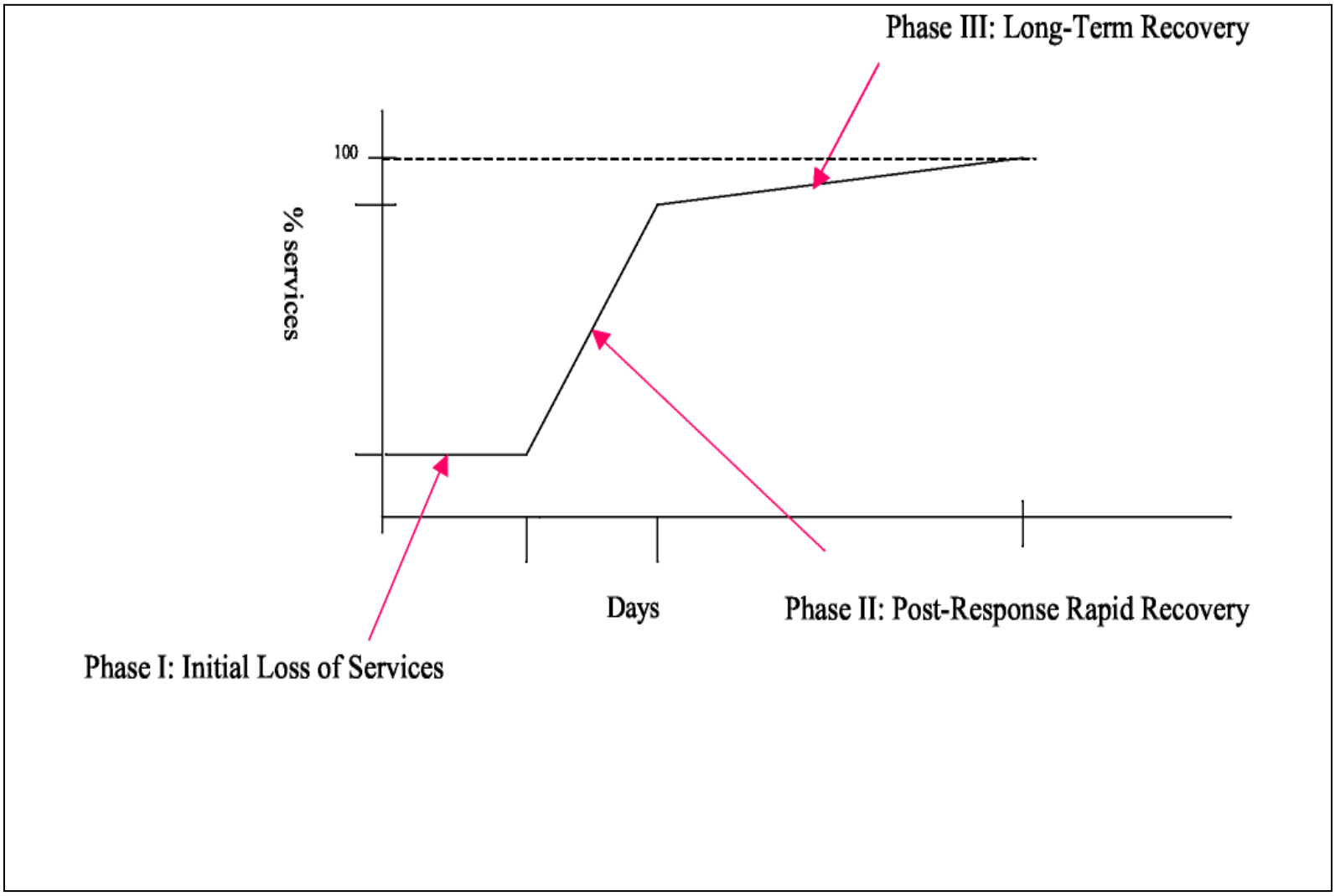


Figure 2-1. General Recovery Curve for Beach and Rocky Habitats

2.5.2 RATIONAL FOR DURATION OF EACH INFLECTION

The rational for percentage loss of services and the duration of those losses are presented in the following section, including the considerations influencing the inflections of the curves for each habitat.

2.5.2.1 Beaches

From the time of the release, the oil was at sea for three days before it was observed on shore, as documented on the SCAT forms starting September 9, 1999. Therefore, 100 percent of the services were available for three days after the release. The initial injury was based on the degree of oil observed stranded on shore. The highest density observed was assigned to that shoreline segment from when the oil came ashore until the end of the response period, which was 7 days in duration (or until 10 days post-spill). The postresponse recovery reflects the rapid recovery of services and was primarily due to the termination of disturbances caused by the cleanup effort and the reduced amount of oil on the beach. The limited amount of oil remaining on shore or coming ashore was weathered, and no longer tacky. The duration of the rapid recovery ranged from 15 to 30 days from time of spill depending on the type of injury and degree of oiling. The longterm recovery was based on the slower recovery of organisms from the presence of residual oil on shore and re-colonization of affected habitat. The more densely oiled areas recovered by 120 days after the release, while the less densely oiled areas recovered in 33 days after the release.

The percentage of service loss due to the initial phase of the recovery curve was dependent on the degree of stranded oiling. The degree of oiling was applied to all injury types within a beach segment. The greater the density of oil, the greater the services were injured. The initial loss due to the stranded and wrack injuries were a result of smothering and fouling of organisms beneath the stranded oil as well as the disturbance by the cleanup and response efforts. The initial loss due to the moving injury was caused by the oil mixing in each incoming wave. The moving oil presented toxicity to the organisms that inhabited the surf area of the beaches. For the HEA assessment, the "worse-case" degree of oiling was assigned to each segment of beach for the duration of the oiling (i.e., 7 days). Once the oil was presumed to no longer be coming ashore and removed from the shores to the extent practical, only residual oil remained on the shore, primarily in areas inaccessible to cleanup crews.

During the second phase, the service losses rapidly recovered to some percentage below the baseline of services. This rapid recovery is due mainly to these factors: the weathering and hardening of the oil remaining on shore and/or the limited amounts of oil still coming ashore, and the end of the cleanup/response effort. The weathered oil no longer had a sticky consistency; therefore, incidental contact with the oil would not cause fouling of an organism. The cleanup crews, SCAT teams, and other reconnaissance teams were no longer present on the beaches. Vehicular and pedestrian traffic activity levels had substantially increased during the response effort, but injury from this disturbance quickly returned to baseline level once this increased activity ceased.

The third phase, the long-term recovery, involved the depuration of oil and toxins from the organisms affected by the moving oil. During the cleanup efforts of the stranded oil, sand, vegetation, and debris were removed from the beaches. The duration of the long-term recovery was dependent on the re-establishment of the vegetation and debris on the beaches and the re-colonization of this wrack material. A summary of the percent service losses and duration of each phase of recovery are shown in Table 2-4.

Broken Stranded w/ Wrack		**Broken Moving**	
Time (days)	% Services	Time (days)	% Services
0	100	0	100
3	100	3	100
3	0	3	10
10	0	10	10
33	50	24	80
120	100	90	100
Patchy Stranded w/ Wrack		**Patchy Moving**	
Time (days)	% Services	Time (days)	% Services
0	100	0	100
3	100	3	100
3	50	3	50
10	50	10	50
33	80	24	90
120	100	60	100
Sporadic Stranded w/ Wrack		**Sporadic Moving**	
Time (days)	% Services	Time (days)	% Services
0	100	0	100
3	100	3	100
3	85	3	90
10	85	10	90
33	95	17	95
120	100	33	100
Trace Stranded w/ Wrack		**Trace Moving**	
Time (days)	% Services	Time (days)	% Services
0	100	0	100
3	100	3	100
3	95	3	95
10	95	10	95
33	100	15	100

Day 0 = time of release -10

Day 3 = first observation of oil on shore

Table 2-4. Beach Habitat Percent Service Losses and Duration

2.5.2.2 Rocky Habitats

Based on the service flows injured and the mechanisms for oiling, the tidepools and rocky intertidal habitats had similar recovery curves. Though the offshore rocks, riprap and cliffs recovery curves differed from the tidepools/rocky intertidal, they were similar to each other. These curves are described below.

2.5.2.2.1 Tidepools and Rocky Intertidal

From the time of the release, the oil was at sea for three days before it was observed on shore, as documented on the SCAT forms starting September 9, 1999. Therefore, 100 percent of the services were available for three days after the release. The initial period of service loss extends to 30 days, since crews were unable access or effectively clean these areas. However, by 30 days, the oil became weathered and volatile components dissipated, and any residuals either stranded themselves in crevices or on shorelines. Examples of the types of injuries that might be associated with these weathered residuals include ingestion of the oil by mobile organisms such as snails and starfish, and/or oil stranding on stationary organisms such as sea urchins and mussels. This middle phase of recovery was estimated to take 60 to 120 days after spill for the rocky intertidal depending on the degree of oiling. The middle phase of recovery was estimated to take 90 days for the tidepools because of the pooling characteristics of this habitat. The remainder of the recovery (long term recovery) occurred over the next 210 days (270 days from time of spill).

2.5.2.2.2 Offshore Rocks, Riprap, and Cliffs

From the time of the release, the oil was at sea for three days before it was observed on shore, as documented on the SCAT forms starting September 9, 1999. Therefore, 100 percent of the services were available for three days after the release. Because of the high wave action associated with, and non-porous surfaces of the offshore rocks, riprap and cliffs, the overall percent service losses and duration of injuries are considerably less than with the other habitats, given the degree of oiling. The initial injury caused by the oil splashing against the rock surfaces extended for a period of 10 days. The flushing effects of the high wave action in these areas resulted in a rapid post spill recovery of 24 days, with the long-term injuries recovering in a total of 60 days after spill. A summary of the percent service losses and duration of each phase of recovery are shown in Table 25.

Tidepool Habitat North of Trinidad Point – Sporadic

Time (days)	% Services
0	100
3	100
3	50
30	50
90	90
270	100

Rocky Intertidal North of Trinidad – Sporadic

Time (days)	% Services
0	100
3	100
3	75
30	75
60	90
270	100

Rocky Intertidal South of Trinidad - Patchy

Time (days)	% Services
0	100
3	100
3	50
30	50
120	90
270	100

Offshore Rocks and Cliff North of Trinidad - Sporadic

Time (days)	% Services
0	100
3	100
3	75
10	75
24	90
60	100

Offshore Rocks, Riprap and Cliff South of Trinidad – Patchy

Time (days)	% Services
0	100
3	100
3	50
10	50
24	80
60	100

Table 2-5. Rocky Habitat Percent Service Losses and Duration

2.6 CALCULATION OF DEBIT

The degree, extent, and duration of oiling parameters presented above were used in the HEA model. This model is discussed in Appendix A. The HEA model allows for the various injury types to be summed within each habitat. For the beaches, the debit for each of the four degrees of oiling for the stranded/wrack and moving injury types were calculated and then summed. The total debit for the beach habitats is 58.6 discounted services per acres per years (DSAYs). The HEA debit for the rocky habitat sums the injuries from the tidepools, and the two degrees of oiling to both the rocky intertidal and the offshore rock/riprap/cliff habitat. The total debit for the rocky habitats is 10.4 DSAYS. A summary of the debits for each individual category/habitat pair is presented in Tables 2-6 and 2-7.

	DEBIT		
Oiling Category	Stranded (DSAYs)	Moving (DSAYs)	Total (DSAYs)
BROKEN	6.5	44.0	50.4
PATCHY	0.9	3.0	3.9
SPORADIC	0.5	1.2	1.6
TRACE	0.1	2.5	2.6
TOTAL	8.0	50.6	58.6

Table 2-6. Beach Habitat Debit Summary

Habitats	Oiling Category	DSAYs
tidepools - north	SPORADIC	2.9
rocky intertidal/combo north	SPORADIC	4.4
rocky intertidal/combo south	PATCHY	1.7
cliff north w/ offshore rocks	SPORADIC	0.5
cliff south w/ riprap & offshore rocks	PATCHY	0.9
TOTAL		10.4

Table 2-7. Rocky Habitat Debit Summary

2.7 SUMMARY

This chapter of the Habitat Injury Report described the injury assessment for the shoreline habitats for the Dredge *Stuyvesant* oil spill, which occurred on September 6, 1999. The approach used for the shoreline injury assessment included a description of the habitats (i.e., natural resources) and services provided by those habitats, the degree of injury to these services, the considerations for the kinds of recoveries of these services, and finally, a summary of the service losses.

The Stuyvesant Technical Group worked cooperatively to develop this approach and to estimate the input parameters used in the calculations of total service losses. The HEA model was agreed upon as an appropriate approach for the shoreline injury assessment. HEA focuses on the ecological services provided by the affected habitats. The first step of HEA is to identify the services that the affected habitat would have provided had it not been injured. Second, the amount of service reduction caused by the oil spill is estimated over time. The sum of service losses over time is called a HEA "debit." Next, the amount of service gain that will be produced by the restoration project(s) is determined, which gives a HEA "credit" per acre of restoration project. Finally, dividing the debit by the credit per acre of restoration project results in the acres of restoration project needed to compensate for the injuries.

The HEA debits are expressed in debit service acre years (DSAYs). The shoreline habitat injury debit was calculated to be 58.6 and 10.4 DSAYs for the beach and rocky habitats, respectively. The HEA debits will be used to scale the restoration projects needed to compensate for the injuries. The HEA credit analysis will be completed in a cooperative process, and summarized in subsequent chapters in this report as it is completed.

Pending

Pending

Appendix K

Rocky Intertidal Injury to Wetlands REA Details

INJURY CALCULATION
Injury to rocky intertidal habitat is **10.4** discounted acre-years of resource services (see Appendix J for details).

CREDIT CALCULATION (projected restoration benefits *per acre*)

Year	% of Potential Resource Services	Resource Services Per Acre	Discounted to 1998
2006	0%	0.00	0.00
2007	5%	0.05	0.04
2008	10%	0.10	0.07
2009	15%	0.15	0.11
2010	20%	0.20	0.14
2011	25%	0.25	0.17
2012	30%	0.30	0.19
2013	35%	0.35	0.22
2014	40%	0.40	0.24
2015	45%	0.45	0.26
2016	50%	0.50	0.29
2017	55%	0.55	0.30
2018	60%	0.60	0.32
2019	60%	0.60	0.31
2020	60%	0.60	0.30
2021	60%	0.60	0.30
Continues to 2107.			Discounted at 3% per year
		Total:	**12.3**

Number of acres needed for project would be 10.4/12.3 = **0.8 acres**.

Appendix L

Sandy Beach Injury to Dunes REA Details

INJURY CALCULATION
Injury to sandy beach habitat is **58.6** discounted acre-years of resource services (see Appendix J for details).

CREDIT CALCULATION (projected restoration benefits *per acre*)

Year	% of Potential Resource Services	Resource Services Per Acre	Discounted to 1998
2006	0%	0	0.00
2007	10%	0.10	0.08
2008	20%	0.20	0.16
2009	30%	0.30	0.24
2010	40%	0.40	0.31
2011	50%	0.50	0.37
2012	60%	0.60	0.43
2013	60%	0.60	0.42
2014	60%	0.60	0.41
Continues to 2036.			Discounted at 3% per year
		Total:	**8.3**

Number of acres needed for project would be 58.6/8.3 = **7.1 acre**

Appendix M

Synopsis of Written and Oral Public Comments with Trustee Responses

The Stuyvesant Trustees received thoughtful and relevant comments on the Draft DARP during the public review process. In reviewing and evaluating public comments and proposals, the Trustees have applied the Restoration Project Selection Criteria (Section 4.2.4). Although some of the suggestions were not incorporated into the final plan, others have enhanced the final plan. The comments received have been grouped below into similar subject matter headings and the Trustees' responses are presented below each comment.

1. **How many marbled murrelets are there in Grizzly Creek compared to Redwood National and State Parks?**

While both the Grizzly Creek complex and Redwood National and State Parks (RNSP) both contain marbled murrelet habitat, there are no precise estimates of the numbers of marbled murrelets nesting in either area. However, since RNSP is considerably larger and at-sea surveys find greater numbers offshore, it is reasonable to infer that RNSP supports more marbled murrelet nesting than does Grizzly Creek.

2. **The trustees should consider Redwood National and State Parks as a restoration site to compensate for marbled murrelet injuries.**

The trustees have considered Redwood National and State Parks (RNSP) as a potential site for restoration. In fact, the corvid control restoration concept and costs are based in part upon information provided by RNSP staff.

The large contiguous area of murrelet habitat in RNSP makes it one of the most ecologically significant murrelet nesting areas in California and offers the potential for achieving relatively long term benefits from restoration actions. In addition to being the likely nesting area of many Northern California marbled murrelets, its geographic relationship to the spill trajectory suggest that many of the murrelets killed by the spill probably nested in RNSP (although some may also nested in southern Humboldt County).

However, because the Mamu habitat under the jurisdiction of RNSP is already in public ownership and therefore relatively well protected, the trustees believe that greater benefits to this species can be provided by preserving relatively less protected habitat that is in private ownership. On the other hand, the Trustees have selected as a preferred project corvid control activities in RNSP.

3. **The responsible party should pay the price of the Grizzly Creek MMCA at the time of settlement.**

The primary responsibility of the trustees is to attempt to obtain for the public fair compensation for the injuries resulting from the *M/V Stuyvesant Oil* spill. For the human recreational use impact, this is the estimated dollar value of lost and devalued recreational use. For biological resources, this compensation can take the form of either biological restoration projects that provide equivalent service value or the dollar cost of performing such restoration projects. When

compensation is achieved through implementation of a biological restoration project, the specific dollar price of the project is not directly relevant, so long as the appropriate resource gains are achieved.

4. **Protection of second-growth forest should be considered one of the "preferred alternatives" for compensating for marbled murrelet injuries.**

Protection of second-growth forest is not considered one of the "preferred alternatives" primarily because of the uncertainty and timing of the benefits to marbled murrelets.

While relatively young second-growth forest can be used to buffer current old-growth habitat, the primary motivation behind protecting expansive stands of second-growth is the future, successful nesting of marbled murrelets at those sites. Under natural conditions, the development of nesting structures in these trees will occur in the far future (i.e., many second growth trees are younger than 50-years old, and the trustees do not expect benefits to marbled murrelets until stands are older than 200 years in age). If current restoration actions are not successful in increasing the population numbers in the short-term, marbled murrelet populations will either maintain current numbers or continue to decline. If this is the case, restoration strategies focused on second-growth protection run the risk of producing habitat far in the future that will not be utilized by marbled murrelets because there are insufficient numbers to fully occupy those areas.

5. **The silvicultural management of second-growth forest should be considered one of the "preferred alternatives" for compensating for marbled murrelet injuries.**

Similar to second-growth protection, silvicultural management of second-growth forest is not considered under the preferred alternative because of the uncertainty and timing of the benefits to marbled murrelets.

It has been suggested that second-growth stands in the redwood region can be successfully managed to decrease the time it takes for marbled murrelet habitat to develop. Carey et al.(2003) argue that "there is sufficient scientific knowledge to warrant implementation of restoration thinning projects on a large scale (i.e., involving hundreds to thousands of acres)" (p.2). This conclusion is based primarily upon the observations that silviculture can (1) increase the growth of large limbs and (2) provide canopy cover to prevent growth of understory used by predators of murrelet nests. While these methods have yet to be tested for the enhanced creation of murrelet habitat, it is reasonable to believe that silvicultural management can achieve these two goals, given success in adapting the range of possible management options to "specific stand conditions" [p.2])

Success in enhancing platform nesting branches and reducing habitat for nest predators does not, however, address two fundamental concerns that the trustee council had with "second-growth management" restoration concept.

First, as long as the successfully managed second-growth is in the close proximity of unmanaged second-growth (or other sources of nest predators), reduction of onsite habitat will have very uncertain impact on the actual rate of nest predation, and thus, runs the risk of providing little benefit to marbled murrelets.

Second, by all accounts, the emergence of suitable nesting characteristics will occur far into the future. Carey et al. (2003) suggest that silvicultural management take place when stands are 40- to 80-years-old (p.2), and that it is their "best professional judgment" that new nesting habitat will begin to emerge in "the 40th year post-treatment" (p.48). The trustees believe that this assessment is optimistic, as well as unclear on how habitat with newly "emerging" characteristics compare to currently established nesting areas. However, it is still straightforward to conclude that the likelihood that murrelets actually expand into these "emerging areas" (and therefore derive benefit from them) will be a function of a very uncertain population trend in the near term.

If current restoration efforts are not successful in increasing the population numbers in the next 40 to 120 years, than management of second growth is unlikely to be of much benefit to marbled murrelets, even if such management is extremely successful at achieving its habitat construction objectives.

6. How does the recent purchase of Grizzly Creek MMCA by the Wildlife Conservation Board (WCB) affect the proposed acquisition project contained in the M/V Stuyvesant Natural Resource Damage Assessment Restoration Plan?

Acquisition of the Grizzly Creek Marbled Murrelet Conservation Area (MMCA) began in 1999 with State funds allocated through Assembly Bill 1986. At that time, approximately 716 acres were purchased from Pacific Lumber Company. The State funds were insufficient to buy the entire MMCA, which is approximately 1400 acres in size. The State and federal incidental take permits associated with the Headwaters Forest project, including the associated Pacific Lumber Company Habitat Conservation Plan and the Implementation Agreement, prohibited logging of the MMCA for a five-year period in order to provide an opportunity for purchase and permanent protection of any unacquired lands.

In the fall of 2003, the Wildlife Conservation Board (WCB) approved the acquisition of, and the state acquired, the remaining 691 +/- acres of the MMCA with bond monies from the California Clean Water, Clean Air, Safe Neighborhood Parks and Coastal Protection Act of 2002 (Prop. 40), California Public Resources Code Section 5096.650. This acquisition was undertaken with the understanding that funds earmarked for marbled murrelet habitat acquisition obtained by the trustees through a settlement or civil judgment might be used to reimburse the Prop. 40 funds with which WCB acquired the MMCA. Consequently, acquisition of the Grizzly Creek MMCA remained one of the preferred restoration alternatives in the draft Restoration Plan. However, the Trustees retained the authority to select and implement alternative restoration projects after considering public comments as provided by the Oil Pollution Act, the National Environmental Policy Act, the California Environmental Quality Act, and court approval.

Acquisition of the remainder of the Grizzly Creek MMCA remained one of the preferred restoration alternatives in the draft Restoration Plan. The draft Restoration Plan contemplated reimbursing all or a portion of the Propostion 40 funds that were used to acquire the remaining MMCA acres before the 5-year option expired in March 2004. The funds would have then be used by WCB to fund future Proposition 40 qualifying projects.

After the draft DARP was completed, the Responsible Party submitted to the Trustees an alternative Marbled Murrelet habitat preservation project. This project proposal was released for public review concurrently with the draft DARP. The project is for a conservation easement on

old growth parcels and surrounding second growth timber, known as the Miracle Mile Complex, currently owned by Green Diamond Resource Company (Miracle Mile project; Humboldt County). After consideration of public comment regarding, and other factors related to, the Grizzly Creek and Miracle Mile projects, the Trustees selected the Miracle Mile project as the preferred restoration project. Rationale for the Trustees' decision include the larger acreage of unentered old growth acreage contained in the Green Diamond parcel, increased cost-effectiveness of the Green Diamond project, and considerably greater threat of harvesting in Green Diamond parcel versus the MMCA.

7. **Is the Redding Rock common murre project site abandoned, or are the trustees proposing to enhance an existing colony?**

Currently, there is a very small colony at Redding Rock. It is in danger of extirpation due to its small size and proximity to disturbance sources. It addition to reducing this disturbance, the trustees plan to implement social attraction using decoys. This aims at increasing the area of the rock used by common murres.

8. **Would there still be benefits to the Redding Rock common murre project if the USCG voluntarily decommissions (or alters the management of) their navigational light outside of this scope of the project?**

Trustee agencies have already been in contact with the USCG regarding the light because of its potential contribution to the decline in the common murre colony. While this is an important element of the Redding Rock project, it is only one of the elements. If management of the light is decommissioned outside the scope of the trustee restoration project, the Redding Rock project would still likely include other disturbance reduction measures, as well as social attraction elements (as needed).

9. **Would the human use project at Patrick's Point be completely funded by the M/V Stuyvesant oil spill settlement funds?**

At the time of the Draft DARP, the trustees believed that a portion of the settlement funds received to compensate for human use losses would be sufficient to completely fund the Patrick's Point project. However, the project proponent has since advised the Trustees that the available funds may not be sufficient to fund all components of the Patrick's Point project; the Trustees will work with the proponent to ensure that funds are used efficiently to maximize human use benefits gained from this project.

10. **Consider implementing the following projects in the Clam Beach area to compensate for impacts to western snowy plovers:**

    a. **Installation and maintenance of exclosures around snowy plover nests;**
    b. **Preparation and installation of education signs related to the western snowy plover;**
    c. **Funding of weekly surveys for western snowy plover nests and chicks during the breeding and nesting season (March 1 to September 1);**

d. Installation of a new chain link fence at the base of the hill north of the Vista Point Overlook to control public access to Clam Beach during the breeding and nesting season of western snowy plovers;
e. Funding of a beach patrol ranger from March 1 to September 1; and
f. Preparation of a multi-species habitat conservation plan for the Clam Beach area

The Trustees agree that Clam Beach is an appropriate location for projects to compensate for impacts to snowy plovers and beach habitat. Clam Beach was one of the most heavily oiled beaches and observers estimated that 10 of the 30 snowy plovers observed at Clam Beach during the spill were oiled. In the Draft DARP, the Trustees considered several measures to benefit snowy plovers at Clam Beach, including restriction of vehicle access to protect dune species, eradication of European beach grass, installation of signs and fencing to protect nests from human disturbance, and predator control.

Beach grass eradication and disturbance reduction (signs and fencing) were identified as tentatively preferred projects. Monitoring nesting areas and plover nests to evaluate effectiveness of the restoration measures at enhancing plover fledging success was also included as part of the tentatively preferred projects. These measures encompass items (a) – (c) from the list recommended by the commenter. The construction of a chain link fence at the base of the hill north of the Vista Point Overlook (d) was not one of the measures considered by the Trustees, but fencing nesting areas with a less obtrusive material was considered and identified as a tentatively preferred alternative.

The Trustees continue to prefer the combination of nesting habitat enhancement through European beach grass eradication and nest protection through installation of signs and fencing as the best approach for compensating for the impacts of the Stuyvesant spill on snowy plovers and sandy beach habitats. If monitoring data indicate that snowy plover reproduction is not improved by these measures, the Trustees would consider contributing towards the funding of a seasonal ranger to patrol Clam Beach and assist with public outreach and other plover protection measures (item [e] on the above list).

The Trustees consider item (f), development of a multi-species habitat conservation plan for the Clam Beach area, to be beyond the scope of restoring resources injured by this oil spill.

11. Consider implementing the following projects in the Clam Beach area to compensate for lost recreational uses resulting from the spill:

a. Install infrastructure for a seasonal camp host/beach ranger;
b. Install a pay phone;
c. Construct a ten car parking lot with stairways at the west end of Crannell Road to provide access to Little River State Beach and install chemical restrooms; and
d. Build a changing room/rinse off station/restroom at Moonstone Beach.

The Trustees considered several different options for compensating for human use. Based upon our restoration project selection criteria (see Section 4.2.4.) and public comments, the Trustees selected both the Patrick's Point and the McDaniel Slough projects to compensate for lost recreational uses.

12. The City of Arcata supports salt marsh and bird restoration projects in Humboldt Bay and would be willing to work cooperatively with the Trustees on these projects, including the Old Arcata Wharf pelican and cormorant enhancement project.

The Trustees appreciate the City's support. However, since the preparation of the draft DARP the Trustees have reconsidered the Old Arcata Wharf Project and now prefer the Pelican Roost Site Protection Project. The Pelican Roost Site Protection Project will rely on a more natural solution and will not cause construction disturbance to the shoreline habitat of the Old Arcata Wharf area.

13. The Trustees should consider the McDaniels Slough Wetland Restoration project as an alternative to the Hookton Slough Wetland Restoration project, or as a project to compensate for recreational use losses that resulted from the spill.

The Final DARP has been updated to include the McDaniels Slough Wetland Restoration project as a preferred alternative, replacing the Hookton Slough project which was a preferred alternative in the Draft DARP. Comparison of the two projects indicate that they would achieve comparable benefits and the McDaniels Slough project would probably provide these benefits faster because it is further along in the planning and permitting process. It also offers possibilities for simultaneously addressing some of the human use losses resulting from the spill.

14. Regarding the Humboldt Trails project concept, what aspect of the larger plan would be funded? The Trustees should consider Elk River Wildlife Area as a Humboldt Trails project.

In the Draft DARP, the Trustees had not identified a specific component of the Humboldt Trails plan for funding. For the Final DARP (after legal settlement of the Stuyvesant case), the Trustees re-evaluated the human recreation use projects (see Section 4.2.4 of the Final DARP for project selection criteria), including access improvements for various wildlife areas. As a result of this re-evaluation, the Trustees selected the McDaniels Slough Wetland Restoration project as a preferred alternative. The basis for this decision, as indicated above, was due in large part to a relatively broad array of benefits offered by the project, including marsh habitat, wetland bird foraging, and human recreational use.

15. Does the settlement consider "interest" that could be earned between the time of the spill and the time of restoration?

The calculations used to assess the biological restoration and human use compensation incorporate the lag between the spill and restoration. In general, the farther settlement and restoration occur in the future, the more restoration is needed to compensate the public. This practice is called "discounting" and it is similar to the idea of compounding interest.

16. Did the trustees work with the responsible party on developing the restoration plan?

The information provided to the public in the Draft DARP and discussed at the public meeting accurately represents, in summary, the dialogue between the trustees and the RP. In addition, shortly before the public meeting, the RP proposed, and the trustees sought comment concerning, protection of a privately held parcel of forest habitat to compensate for the injury to marbled

murrelets. The trustees, having considered all relevant factors, concluded that the RP's proposal to protect approximately 625 acres of timber known as the Miracle Mile complex is superior to their proposed project to reimburse WCB for the acquisition of a portion of the Grizzly Creek MMCA. As to the other injuries, the parties worked closely in "scaling" the size of the restoration projects, and the RP has, in general, deferred to the trustees as to particular projects.

17. What is the status of the M/V Kure settlement?

In general, the Kure matter is proceeding at a slower pace than Stuyvesant. Both sides hope that they can reach a settlement without the need for litigation, however.

18. Is there a way to combine Kure and Stuyvesant Settlements to get more efficient restoration?

Although there is probably no realistic way to combine the two settlements in the same court proceeding, in the restoration planning processes, the trustees will seek complementary restoration approaches.

19. Comments regarding the Trustees' Marbled Murrelet mortality estimates and population assumptions:

a. Ford's model has considerable "error bars" around the mortality estimate.
b. Headwaters "protected as many birds" as estimated killed in the M/V Kure (Stuyvesant?) spill. The Headwaters transaction should be used as a basis for determining the size of the old growth parcel to be protected to restore MAMUs killed by the spill.
c. The new MAMU population estimates for the Southern Humboldt areas are lower than we previously thought making the impact of the oil spill(s) on the local MAMU population even graver.

Responses:

a. There is considerable uncertainty in the acute mortality estimates for Marbled Murrelets. Estimating total acute mortality from bird carcasses collected at a spill is a complicated process. The Trustees relied upon a peer-reviewed modeling framework (Ford et. al 1987, Page et al.1990, Ford et. al 1996) that incorporates correction factors to address various factors that can have a significant downward influence on the number of dead birds collected from beaches (and other shoreline areas). Specifically, the correction factors address carcass scavenging, searcher efficiency, and unsearched areas. Inputs to the modeling framework were derived from studies conducted in the Humboldt area.

Unfortunately, all scientific modeling inevitably has some degree of uncertainty. For the Stuyvesant spill, there is greater uncertainty in the Marbled Murrelet acute mortality estimate than for estimates of some of the other species (e.g., Common Murre). This is because: (1) there were fewer carcasses available upon which to base an extrapolation; (2) Marbled Murrelets are more difficult to find because they are relatively small; and (3) Marbled Murrelets are more quickly removed by scavengers. The second and third factors cause smaller absolute variation in acute mortality model inputs to have larger proportional impacts on output estimates.

The Trustees reduced error from uncertainty by choosing “average values” of inputs where possible. This helps balance the possibility of over-estimating versus underestimating mortality loss. Although uncertainty exists in the estimate, the Trustees believe the estimate is a defensible number based on the available information and data.

Citations

Ford, R. G., G. W. Page, and H. R. Carter. 1987. Estimating mortality of seabirds from oil spills. Proceedings of the 1987 Oil Spill Conference, Baltimore, MD. American Petroleum Institute. pp. 547-551.

Ford, R.G., M.L. Bonnell, D.H. Varoujean, G.W. Page, H.R. Carter, B.E. Sharp, D. Heinemann, and J.L. Casey. 1996. Total direct mortality of seabirds from the *Exxon Valdez* oil spill. Pages 684-711 in S.D. Rice, R.B. Spies, D.A. Wolfe, and B.A. Wright, editors. Proceedings of the *Exxon Valdez* oil spill symposium. American Fisheries Society Symposium 18.

Page, G. W., H. R. Carter, and R. G. Ford. 1990. Numbers of seabirds killed or debilitated in the 1986 Apex Houston oil spill in central California. Studies in Avian Biology No. 14: 164-174.

b. Compensation for Marbled Murrelet injuries in the M/V Stuyvesant spill is derived from restoration projects that benefit Marbled Murrelets. Calculations are based upon established and appropriate methodologies for addressing this mortality. The public purchased the Headwaters property from Pacific Lumber Company (PALCO) to preserve a specific old-growth tract and to remove it from the prospect of commercial timber management. The purchase was part of the Headwater's Forest Agreement, which also included a requirement that PALCO develop a Habitat Conservation Plan (HCP) on their remaining PALCO timberlands. This subsequent HCP addresses management of several special-status species, including Marbled Murrelets, in the context of ongoing commercial timber management. Since the Headwaters purchase was neither compensation for specific impacts to nor specifically focused on Marbled Murrelets, it is not appropriate to compare it to the murrelet component of the M/V Stuyvesant spill settlement. The Trustees cannot verify whether or not the same number of birds was protected in the Headwaters Acquisition as was killed by the Stuyvesant spill.

c. The Trustees believe that the loss of 135 Marbled Murrelets, as described in the DARP, is a significant impact to Marbled Murrelets in the vicinity of the Humboldt County. To the extent that the affected birds were part of a smaller (and more isolated) subset of Marbled Murrelets off the coast of California, the Trustees agree that this impact was probably even more significant.

B. Written Comments Received During Public Review Period

United States Department of the Interior
California Department of Parks and Recreation
Redwood National and State Parks
1111 Second Street
Crescent City, California 95531

CALIFORNIA STATE PARKS

A7615

July 7, 2004

Ms. Charlene Hall
U.S. Fish and Wildlife Service
2800 Cottage Way, Suite 2605
Sacramento, California 95825

Dear Ms Hall:

We have reviewed the draft Stuyvesant/Humboldt Coast Oil Spill Draft Damage Assessment and Restoration Plan and commend the technical work group for their efforts in producing this excellent document.

The Plan recommends Redwood National and State Parks (RNSP) and vicinity as the primary site for initiating corvid management, one of two preferred restoration concepts as compensation for marbled murrelet mortalities resulting from the oil spill. The other preferred concept is acquisition of additional old-growth/residual/younger-aged habitat at either Grizzly Creek Marbled Murrelet Conservation Area or Green Diamond Miracle Mile forest complex in Klamath. Three other restoration concepts mentioned in the plan that were not selected as preferred concepts by the technical work group were silviculture of second-growth forest to create nesting habitat, captive breeding, and artificial nest platforms.

RNSP supports the corvid management concept of limiting anthropogenic food sources that may result in unnaturally large corvid populations. There are two ways to attack this problem, by limiting access by corvids to anthropogenic foods, and by educating the public about the importance of proper handling and disposal of food and waste.

RNSP is currently seeking funds to complete bear-proofing all RNSP campgrounds and visitor use facilities. Bear-proofing has the desired effect of corvid-proofing by limiting corvid access to anthropogenic food sources. We estimate that $85,000 is needed to finish bear-proofing all of our campgrounds and visitor use facilities.

We also believe that increased public education programs focused on corvid management can have a positive influence on limiting anthropogenic foods in and around the parks. Currently we are educating the public through limited campfire talks, roving patrols, and brochures explaining the relationship of trash and corvid numbers, and the impacts of corvids to nesting marbled murrelets. Unfortunately, budget challenges are hampering our ability to continue these seasonal programs at effective levels. With additional staffing, we should be able to greatly improve our existing corvid educational programs and also do outreach with the surrounding communities

and state and county agencies in dealing with trash management at landfills and other areas that attract corvids. Education programs can include production of videos, signs, increased campfire or evening talks, television/radio coverage, and increased roving patrols to improve direct public contact. We estimate that these efforts would require approximately $250,000 for five years to hire 4-5 seasonal interpretive staff and to produce educational programs, videos, television/radio coverage, increase campfire and evening talks, and increase public contact through roving patrols and signage.

We recommend that silviculture of second-growth forest to create potential future murrelet nesting habitat be elevated to a preferred project concept, and that RNSP be given consideration as the primary site for implementation. About 50,000 acres of second-growth forest habitat exists within the boundary of RNSP. We are currently working on completing a second-growth forest management plan that will focus on accelerating the return of old-growth forest characteristics to these second-growth stands. A scientific panel to assess restoration of marbled murrelet habitat consisting of Dr. Andrew Carey, Dr. Steven Courtney, Dr. Jerry Franklin, Dr. John Marzluff, Dr. Martin Raphael, Dr. John Tappeiner, and Dr. Dale Thornburgh stated that "there is sufficient scientific knowledge to warrant implementation of restoration thinning projects on a large scale" to accelerate murrelet nesting habitat as appropriate to specific stand conditions. Therefore, we feel that second-growth thinning is a viable technique with likelihood of success in accelerating stand structure that would benefit nesting marbled murrelets. Marbled murrelet populations in RNSP are recognized as the keystone to the recovery and long-term survival of the species in northern California. More than 75 percent of the remaining marbled murrelets left in California may use RNSP at some point in their lives. As such, protection, conservation and recovery of these populations and their habitat in RNSP are critical to accomplishing goals of the marbled murrelet recovery plan.

We also believe that there is recent research that supports the notion that many of the 135 total marbled murrelet oil spill mortalities were murrelets that either nested in RNSP forests or utilized the offshore waters within the park. Dr. Richard Golightly at Humboldt State University studied offshore movement patterns of radio-tranmittered marbled murrelets captured offshore of RNSP and found that they ranged as far south as Trinidad Bay and some beyond Humboldt Bay. Therefore, this could be another supporting rationale for conducting additional restoration work within the RNSP.

We thank you for the opportunity to provide comments on the draft plan. If you have any questions, please contact Howard Sakai at 707 464-6101, extension 5270.

Sincerely,

/s/ Bill Pierce
Bill Pierce
National Park Superintendent

/s/ Richard C. Sermon
Richard C. Sermon
State Parks Superintendent

"Geist, Jill"
<Jill.Geist@co.humboldt.ca.us>

06/17/2004 06:00 PM

To: <Charlene_Hall@fws.gov>
cc: "Tuttle, Don" <DTuttle@co.humboldt.ca.us>, "Hofweber, Tom" <THofweber@co.humboldt.ca.us>, "Riccomini, Kathy" <KRiccomini@co.humboldt.ca.us>, "Neely, Bonnie" <Bonnie.Neely@co.humboldt.ca.us>
Subject: Stuyvesant Spill

Charlene,

I attended the FWS public meeting last night held in Eureka regarding the damage assessment report on the Stuyvesant spill of 1999 . Following the presentation, which outlined various proposed restorations, I queried County staff as to whether we (the County of Humboldt) had submitted any proposed mitigations measures.

In response, Don Tuttle-Deputy Director, provided me with a copy of a letter submitted October 4, 1999 that detailed a series of mitigations. I am unable to discern whether those proposed mitigations had been reviewed and evaluated in the final draft plan.

I will be preparing a formal letter referencing the previous correspondence, but wanted to let you know ASAP of additional pending public comment. If you have any questions, please contact me at (707) 476-2395 or Don Tuttle at (707) 268-2686.

Sincerely,

Jill K. Geist
Humboldt County Supervisor - Fifth District

BOARD OF SUPERVISORS

COUNTY OF HUMBOLDT

825 5TH STREET

EUREKA, CALIFORNIA 95501-1153 PHONE (707) 476-2390 FAX (707) 445-7299

June 18, 2004

Charlene Hall
U.S. Fish and Wildlife Service
1655 Heindon Rd.
Arcata, CA 95521

RE: Stuyvesant/Humboldt Coast Oil Spill
Damage Assessment and Restoration Plan

Dear Ms. Hall:

Pursuant to my e-mail communication to you on June 17, 2004, enclosed are comments from Humboldt County regarding mitigation measures related to the above referenced oil spill. As these comments were originally submitted in October 1999 please assure that they are considered in the final plan.

Should you have any questions, please contact me at 707-476-2395.

Sincerely,

Jill Geist, 5th District Supervisor
County of Humboldt

JG/kr

610.6015
610.6093
Clam Beach

DEPARTMENT OF PUBLIC WORKS
COUNTY OF HUMBOLDT
MAILING ADDRESS: 1106 SECOND STREET, EUREKA, CA 95501-0579
AREA CODE 707

ARCATA EURFKA AIRPORT TERMINAL
McCINLEYVILLE
AVIATION 839-5401

PUBLIC WORKS BUILDING
SECOND & I ST., EUREKA
ADMINISTRATION 445-7491 NATURAL RESOURCES 445-7741
BUSINESS 445-7652 PARKS 445-7652
ENGINEERING 445-7493 ROADS & EQUIPMENT MAINT. 445-7421

CLARK COMPLEX
HARRIS & H ST., EUREKA
REAL PROPERTY SERVICES 445-7205

October 4, 1999

Alix Van Geel
Industrial Economics, Incorporated
2067 Massachusetts Avenue
Cambridge, MA 02140

Re: Mitigation Measures Related to Oil Spill on September 9, 1999 in Humboldt County, CA

Dear Ms. Van Geel:

The purpose of this letter is to provide you with a list of potential mitigation measures for the Clam Beach area to compensate for impacts to the western snowy plover and local users of this county park area. To reiterate some of my comments during our phone conversation, impacts to the western snowy plover could have consisted of oil picked up while walking in polluted areas of the beach, breathing hazardous vapors which had been detected by county environmental health specialists, and eating insects polluted with spill residue. Impacts to local beach users consisted of loss of use of the Clam Beach/Moonstone Beach County Parks during the few weeks clean up crews cleaned up the beaches.

Following is a list of potential mitigation measures:

1. Infrastructure for a seasonal camp host/ beach ranger - $40,000
2. Installation of pay phone- $8,000
3. New chain link fence at base of hill north of Vista Point Overlook to control public access to Clam Beach during the breeding and nesting season of western snowy plovers. $15,000
4. Preparation and installation of education signs related to the western snowy plover. $2,000
5. Weekly surveys for western snowy plovers' nests and chicks during the breeding and nesting season in the year 2000. $5,000
6. Beach patrol ranger March- August 2000. $50,000

7. Preparation of a multi species habitat conservation plan for the Clam Beach area. $40,000
8. Installation of exclosures around western snowy plover nests discovered during surveys in year 2000. $10,000
9. Construction of a ten car parking lot with stairways at west end of Crannell Road to provide access to Little River State Beach. Chemical restrooms. $40,000
10. A changing room/ rinse off station/ restroom at Moonstone Beach. $50,000

It is our understanding 90% of the impact of the oil spill occurred on the Clam Beach to Moonstone Beach area. If you need further details and clarification I can be reached at (707) 445-7652.

Thank you for your cooperation.

Very truly yours,

Donald C. Tuttle
Deputy Director

DCT/jjr

fA, Auttlelwsnowyplover

DEPARTMENT OF PUBLIC WORKS

COUNTY OF HUMBOLDT

MAILING ADDRESS: 1106 SECOND STREET, EUREKA, CA 95501-0579
AREA CODE 707

ARCATA-EUREKA AIRPORT TERMINAL
McKINLEYVILLE
AVIATION 839-5401

PUBLIC WORKS BUILDING
SECOND & L ST., EUREKA

ADMINISTRATION	445-7491	NATURAL RESOURCES	445-7741
BUSINESS	445-7652	PARKS	445-7651
ENGINEERING	445-7377	ROADS & EQUIPMENT MAINT.	445-7421
ARCHITECT	445-7493		

CLARK COMPLEX
HARRIS & H ST., EUREKA
LAND USE 445-7205

January 29, 2001

Joe Lesh
California Department of Fish and Game
619 2nd Street
Eureka, CA 95501

Re: Project Related To Stuyvesant Spill

Dear Mr. Lesh:

Attached is a sheet describing a proposed project, hopefully to be funded by the insurance company for the owner of the Stuyvesant ship which suffered an oil spill a few years ago. Preparation of this project description sheet is in response to our meeting of January 19th, 2001, in which you requested each attendee to send you a project description in a format agreed upon at that meeting.

Very Truly Yours,

Donald C. Tuttle
Deputy Director of Public Works-General Services

cc: Bob Walsh, Parks Supervisor
Jim Watkins, U.S. Fish and Wildlife Services
Karen Kovacs, Dept. of Fish and Game
Lynda Roush, Bureau of Land Management
Paul Kirk, 5th District County Supervisor
John Woolley, 3rd District County Supervisor
Jimmy Smith, 1st District County Supervisor

COPY

DEPARTMENT OF PUBLIC WORKS

COUNTY OF HUMBOLDT

MAILING ADDRESS: 1106 SECOND STREET, EUREKA, CA 95501-0579
AREA CODE 707

ARCATA-EUREKA AIRPORT TERMINAL
McKINLEYVILLE
AVIATION 839-5401

PUBLIC WORKS BUILDING
SECOND & L ST., EUREKA

ADMINISTRATION	445-7491	NATURAL RESOURCES	445-7741
BUSINESS	445-7652	PARKS	445-7651
ENGINEERING	445-7377	ROADS & EQUIPMENT MAINT.	445-7421
ARCHITECT	445-7493		

CLARK COMPLEX
HARRIS & H ST., EUREKA
LAND USE 445-7205

ACCESS CONTROL PROJECT FOR CLAM BEACH COUNTY PARK

Project description: The project would consist of placing four-ton or larger boulders four feet apart to control vehicles accessing Clam Beach County Park. In addition a strong metal gate would be installed along with an information Kiosk.

Purpose: The purpose for controlling access to Clam Beach County Park is to protect three listed species, namely the Western Snowy Plover, Menzies Wallflower and Sand Verbena. Currently several vehicles have uncontrolled access to Clam Beach, Little River State Beach to the north, and other beaches to the south. These beaches and their related dunes, provide habitat for the Western Snowy Plover, Menzies Wallflower and Sand Verbena. U.S. Fish and Wildlife Service has requested the County of Humboldt provide access control in order to protect these species.

Link to spill: Controlling access would protect the three listed species noted above and also provide crowd control during various emergencies such as oil spills. Recently the beach needed to be closed in order to allow spill clean up crews unhampered access to perform cleanup duty.

Cost: $15,000.

Contact person: Donald C. Tuttle, Deputy Director of Public Works, General Services

COPY

DEPARTMENT OF PUBLIC WORKS

COUNTY OF HUMBOLDT

MAILING ADDRESS: 1106 SECOND STREET, EUREKA, CA 95501-0579
AREA CODE 707

ARCATA (Local) ARCATA TERMINAL
McKINLEYVILLE
AVIATION 839-5401

PUBLIC WORKS BUILDING
SECOND & L ST., EUREKA

ADMINISTRATION	445-7491	NATURAL RESOURCES	445-7741
BUSINESS	445-7652	PARKS	445-7651
ENGINEERING	445-7377	ROADS & EQUIPMENT MAINT.	445-7421
ARCHITECT	445-7493		

CLARK COMPLEX
HARRIS & H ST., EUREKA
LAND USE 445-7205

HABITAT CONSERVATION PLAN FOR WESTERN SNOWY PLOWER, MENZIES WALLFLOWER, AND SAND VERBENA

Project description: The project consists of the preparation of a habitat conservation plan for the Western Snowy Plover, Menzies Wallflower, and Sand Verbena, all of which are listed species.
The geographical area covered by the Habitat Conservation Plan(HCP) would be from Centerville Beach, north to Moonstone Beach in the County of Humboldt, California.

Purpose: The purpose of the HCP is to allow the County of Humboldt to apply for an incidental take permit from the U.S. Fish and Wildlife Service, covering the above listed species. Currently the U.S. Fish and Wildlife Service believes that "take" is occurring to the species from activities permitted on these beaches by the County of Humboldt, California Department of Parks and Recreation, Bureau of Land Management, State Lands Commission, Dept. of Fish and Game and U.S. Fish and Wildlife Service. All of these agencies need to receive an 'incidental take' permit in order for certain activities to continue to occur which will, in all probability lead to incidental take type impacts on the three listed species.

Link to spill: As part of the HCP it would be necessary to develop protocols to be followed by the spill clean up crews and containment agencies, following various types of emergencies such as oil spills. These protocols would be necessary to protect listed species during clean up operations.

Cost: $80,000.

Contact person: Donald C. Tuttle, Deputy Director of Public Works, General Services

COPY