Castro Cove/Chevron Richmond Refinery

DRAFT

Damage Assessment and Restoration Plan/ Environmental Assessment

November 2008

Prepared by:

National Atmospheric and Oceanic Administration

United States Fish and Wildlife Service

California Department of Fish and Game

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EXECUTIVE SUMMARY

Background

Chevron Products Company (Chevron) owns and operates a petroleum refinery in Richmond, California which, prior to 1987, discharged wastewater directly into Castro Cove, a small embayment within San Pablo Bay. Although the wastewater discharge was relocated outside of Castro Cove in 1987, some of the sediments inside the Cove retained elevated levels of contaminants, including mercury and polycyclic aromatic hydrocarbons (PAHs). In 2007 and 2008 Chevron undertook a major, on-site cleanup project, removing the most highly contaminated sediments within Castro Cove, in compliance with an order issued by the California Regional Water Quality Control Board. In addition to the $20 to $30 million in cleanup costs estimated by the Trustees, Chevron is liable for "natural resource damages."

Natural resource damages, which are used to fund environmental restoration projects, are compensation for the diminished ecological value of injured resources, including contaminated habitats, such as the intertidal mudflat, salt marsh, and other shallow subtidal habitat in Castro Cove. The Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), the United States Department of the Interior's Fish and Wildlife Service (USFWS), and the California Department of Fish and Game (CDFG) are the federal and State trustee agencies (Trustees) for the natural resources injured by the releases into Castro Cove. As a designated Trustee, each agency is authorized to act on behalf of the public to assess injuries to those natural resources under its trusteeship resulting from the releases of contaminants and to recover damages to make the environment and the public whole.

This summary explains how the Trustees assessed the loss of natural resource services and developed a draft plan to compensate for the resource losses by restoring or improving the function of comparable habitats.

Damage Assessment and Restoration Plan (DARP)/Environmental Assessment (EA)

The Trustees have prepared this Draft DARP/EA to inform the public about the natural resource damage assessment (NRDA) and restoration planning conducted thus far for the Castro Cove releases. Consistent with standard practice, the Trustees invited Chevron to work cooperatively on the NRDA for the Castro Cove case. Chevron accepted the invitation, and representatives of Chevron and the Trustees coordinated technical activities to determine and quantify the injury and to scale and plan restoration actions. The Draft DARP/EA describes the injuries and proposes restoration alternatives. The document also serves, in part, as the Trustees' compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). Prior to preparing this document, the Trustees sought and incorporated input from numerous governmental and stakeholder organizations. At this time, the Trustees are seeking comments from the public on the restoration alternatives described in the Draft DARP/EA.

Injury Quantification

The cleanup of Castro Cove sediments undertaken by Chevron addresses restoration of the ecological health of the injured resources. Therefore, the Trustees' NRDA efforts have focused on compensation for lost natural resource services from 1980 (when the Trustees received statutory authority to pursue damages) until the cleanup actions and natural processes will allow the injured habitats to recover to their baseline ecological conditions. The Trustees quantified injuries to natural resources using Habitat Equivalency Analysis (HEA), a commonly used method of scaling injuries and restoration actions. To estimate the amount of natural resource services that the habitats in Castro Cove would have provided had they not been contaminated the Trustees relied on amphipod toxicity tests. Amphipods (a type of small crustacean that inhabits bay mud) were placed in sediment from Castro Cove and their survival was studied in a laboratory. The Trustees used the estimates of amphipod mortality as a surrogate measurement of total ecological injury because amphipods and other benthic invertebrates form the base of the food web. In other words, injury to benthic invertebrates results in injury to other organisms that depend on them for food.

Image of a gammarid amphipod

Restoration Planning

After estimating the total resource injury caused by the contamination in Castro Cove, the Trustees identified and evaluated a range of possible project alternatives that could provide ecological services of the same type as those that were estimated to be lost. The Trustees also calculated how large such a restoration action must be to provide resource service gains equal to service losses estimated to have been caused by the release of contaminants. Based on the Trustees' best estimates, approximately 203 acres of tidal wetland habitat restoration would be needed to offset the loss of services calculated in the injury assessment.

The Trustees' restoration strategy is to identify and implement projects that improve the ecological function of habitats in San Pablo Bay that at present are not fully functional and that are identical or similar to the intertidal mudflat, salt marsh, and shallow subtidal habitat that was injured in Castro Cove. The Trustees consulted with local scientists, several public and private organizations, and State, federal and local governments to identify a reasonable range of restoration projects. The Trustees then evaluated these potential projects against a set of State and federal criteria, including two threshold criteria: (1) relationship of the proposed restoration project to the injured resources and/or lost services and (2) proximity of the proposed project to the affected area. In particular, the Trustees sought out projects located within the North Bay subregion of San Francisco Bay, the same ecological subregion in which Castro Cove is located. Additional criteria were then applied to emphasize project differences and determine which projects would provide the greatest resource benefits in the most efficient manner. Lastly, the Trustees identified the preferred restoration

alternative (other potential restoration alternatives analyzed by the Trustees are discussed in the Draft DARP/EA).

Preferred Alternative

The Trustees have identified a combination of two projects as their preferred alternative from among the seven tidal and three subtidal wetlands restoration projects evaluated in the Draft DARP/EA. They propose to provide settlement funds for a proportional share of the Cullinan Ranch restoration project (estimated contribution: 173 acres of the 1,500 acre project) and to reserve another portion of the settlement funds to be applied toward the restoration of the 30-acre tidal wetlands portion of the Breuner Marsh project.

Cullinan Ranch

Cullinan Ranch is located in the North Bay subregion in Solano County, approximately 10 miles north of Castro Cove. This project consists of returning approximately 1,500 acres of diked baylands to their historical wetland state as mature tidal marsh. A proportional share of this project equating to 173 acres would be funded by a settlement with Chevron for Castro Cove natural resource damages. This project ranks high in technical feasibility since planning and design have been completed and an environmental impact analysis is nearing completion. This project will not only provide resource benefits similar to those lost in Castro Cove but the amount of the settlement funds which the Trustees propose to allocate to this project is expected to act as a catalyst for the larger restoration project.

Breuner Marsh

Breuner Marsh is also located in the North Bay subregion in the City of Richmond, south of Point Pinole Regional Shoreline in western Contra Costa County. It was recently acquired by the East Bay Regional Park District. Approximately 113 acres of the property is upland, seasonal wetlands and degraded tidal marsh, and 105 acres are open water, mudflats and other baylands. The restoration design for this project is still conceptual but calls for restoration of up to 30 acres of tidal wetlands as part of a broader set of habitat improvements and improved public access and recreation areas. The project ranks high because it is close to the injured site (approximately 2 miles) and the tidal wetlands restoration will provide resource benefits similar to the injured habitat in Castro Cove. The Trustees understand that the proposed amount allocated to this project in the settlement with Chevron for natural resource damages will not only contribute to the planning and design of the project but also assist in raising additional funds for implementation.

The combination of restoration at Cullinan Ranch and Breuner Marsh was identified as the Trustees' preferred alternative because these projects ranked the highest. Other projects ranked lower for various reasons. Some projects benefitted different types of resources than those injured in Castro Cove; others were located farther from the injury site; others did not provide enough restoration potential or were already funded;

and still others ranked lower because of cost, feasibility, or land ownership issues. Ultimately, in the Trustees' judgment, funding portions of the costs of Cullinan Ranch and Breuner Marsh will best satisfy the evaluation criteria and provide appropriate compensation to restore habitats that support the fishery, birds, and other biological resources injured as a result of the Chevron releases in Castro Cove.

Also, both the Cullinan Ranch and Breuner Marsh projects rank high in regional restoration prioritizing plans. And, as previously mentioned, partial funding from the Castro Cove NRDA settlement for these projects is likely to help secure additional funding from other sources. This, in turn, is likely to accelerate completion of both projects.

After circulating this Draft DARP/EA for public review and comment, the Trustees will carefully consider and respond to comments and prepare a final DARP/EA. The Trustees have negotiated a tentative legal settlement with Chevron and anticipate that the funds from a completed settlement will be sufficient to implement the preferred alternative presented in the Draft DARP/EA.

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ACRONYMS

AOC	Area of Concern
BAF	Bioaccumulation Factor
BCDC	Bay Conservation and Development Commission
CAA	Clean Air Act
CAP	Corrective Action Plan
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DARP	Damage Assessment and Restoration Plan
DOI	Department of the Interior
DSAY	Discounted Service Acre-Year
DWR	California Department of Water Resources
EA	Environmental Assessment
EBRPD	East Bay Regional Park District
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
HEA	Habitat Equivalency Analysis
HQ	Hazard Quotient
LGM	Logistic Growth Model
LRM	Logistic Regression Model
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observable Adverse Effect Level
NRDA	Natural Resource Damage Assessment
NWR	National Wildlife Refuge
OSPR	Office of Spill Prevention and Response
PAH	Polycyclic Aromatic Hydrocarbon
RMP	San Francisco Estuary Institute’s Regional Monitoring Program
RP	Responsible Party
RWQCB	Regional Water Quality Control Board

SCR	Site Cleanup Requirements
TPAH	Total Polycyclic Aromatic Hydrocarbon
TRV	Toxicity Reference Value
USFWS	United States Fish and Wildlife Service
WCCSL	West Contra Costa Sanitary Landfill

1.0 INTRODUCTION

Chevron Products Company (Chevron) owns and operates a 3,000-acre petroleum refinery in Richmond, California which historically discharged wastewater to the south side of Castro Cove, an embayment of San Pablo Bay in the San Francisco Bay estuary. These discharges resulted in elevated concentrations of mercury and polycyclic aromatic hydrocarbons (PAHs) in Castro Cove sediments. Lead pellets also were deposited in a portion of the Cove sediments from past skeet shooting activities. This draft Damage Assessment and Restoration Plan (DARP) and Environmental Assessment (EA) has been prepared by the State and federal natural resource Trustees responsible for restoring natural resources and resource services injured by Chevron's releases of hazardous substances and oil into Castro Cove.

Both federal and State of California laws establish liability for natural resource damages and require responsible parties to compensate for injuries to natural resources and interim-lost services resulting from those injuries. These interim-lost resource services are not addressed by response or clean up actions which provide the primary restoration assisting the site in recovering from injuries. The Trustees use the recovered damages to implement projects that will restore the injured resources and services and/or compensate the public for services lost while the injured resources recover or are restored. Restoration planning undertaken by the Trustees in a natural resource damage assessment (NRDA) provides the link between the natural resource injuries and the restoration actions to compensate for the injuries. 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.

This Draft DARP/EA informs the public about the affected environment, the injuries to natural resources and their quantification, restoration planning, and the proposed restoration actions to address the natural resource injuries in Castro Cove. The Trustees seek comments on the restoration alternatives presented in this document. The Trustees will consider comments received during the public comment period and may select projects other than those presented as preferred in this Draft DARP/EA based on any such comments and analysis of their potential to provide equivalent natural resources to those injured. After consideration of public comments, the Trustees will finalize the DARP/EA and, upon recovering damages from Chevron, commence with restoration project implementation. The Trustees have negotiated a tentative settlement with Chevron and anticipate the funds from such a settlement will be sufficient to implement the preferred alternatives presented in the Draft DARP/EA.

1.1 Purpose and Need for Restoration

The purpose of restoration is to make the environment and the public whole for injuries resulting from the releases of hazardous substances and discharges of oil.

This is accomplished by implementing restoration actions that return injured natural resources[1] and resource services[2] to baseline[3] conditions and compensate for interim losses[4]. The Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), the Department of the Interior's (DOI) United States Fish and Wildlife Service (USFWS), and the California Department of Fish and Game (CDFG) are the federal and State trustee agencies (Trustees) for the natural resources injured by the releases and/or discharges into Castro Cove. 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 and services injured as a result of the releases and/or discharges.

The proposed action, selection and funding of projects that restore natural resources, is needed to compensate for natural resource injuries resulting from historical releases of hazardous substances into Castro Cove. These pollution releases and their impacts are further explained in Section 1.2 and Section 3. The Trustees are proposing restoration actions at this time because of efforts to address historical contamination in Castro Cove. The California Regional Water Quality Control Board (RWQCB) recently issued site clean up orders to Chevron and Chevron has conducted activities to clean up the site.

The Trustees have prepared this Draft DARP/EA to inform the public about the natural resource damage assessment and restoration planning efforts that have been conducted thus far. This document also serves, in part, as the trustee agencies' compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). By integrating the Natural Resource Damage Assessment process established by the Department of the Interior (DOI Rule) under the Comprehensive Environmental Response, Compensation, and Liability Act

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[1] Natural resources are defined 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. (See section 101 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 42 U.S.C. § 9601 *et seq*. and section 11.13 of the Natural Resource Damage Assessment rule (NRDA Rule or DOI Rule) 43 C.F.R. Part 11 established under CERCLA for purposes of assessing natural resource damages resulting from a release of a hazardous substance under CERCLA or a discharge of oil under the Clean Water Act (CWA) 33 U.S.C. 1251-1376.)

[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.

[3] Baseline is the condition that the environment (or a specific resource) would have been in if the releases or discharge in question had not occurred.

[4] Interim losses are those losses that occur from the time of the release/discharge or the date specified in the applicable statute, whichever is later, until the injured resources have either recovered naturally or are restored through an active restoration project.

(CERCLA or "Superfund law," Title 42 U.S.C. Section 9601 et seq.) with the NEPA/CEQA process, the Trustees are meeting the public involvement components of the DOI Rule and NEPA/CEQA concurrently. However, a selected project may have already undergone or may require additional environmental compliance prior to actual implementation.

1.2 Overview of the Site / Summary of Releases

Castro Cove is a shallow, protected embayment in San Pablo Bay with extensive mudflats and salt marsh habitat that is influenced by tidal action. It is located entirely within Contra Costa County and is bordered to the north by San Pablo Bay, to the east by the West Contra Costa Sanitary Landfill (WCCSL) and Wildcat Creek Salt Marsh, and to the south and west by the Chevron refinery in Richmond (Figure 1). Castro Cove is defined as the area immediately north of the Chevron Refinery's North Yard Impound Basin enclosed by a line drawn from the Point San Pablo Yacht Harbor to the WCCSL. Rubble mound seawalls form the northeastern boundary adjacent to the landfill. Castro Creek and Wildcat Creek enter the cove from the south and east. The southeastern boundary consists of salt marsh and a levee containing the Refinery's North Yard Impound Basin. Portions of the southern and western shorelines contain salt marsh habitat with levees, containing a lagoon and the Chevron yacht harbor, running along the remainder of the western shoreline. Chevron leases use of Castro Cove from the State Lands Commission.

Historically, numerous industrial, commercial, and municipal operations discharged wastewater and stormwater runoff directly or indirectly into Castro Cove and the creeks running into the Cove (URS 1999). Ongoing nonpoint sources, such as urban runoff, are likely to continue into the future.

In 1902, refinery operations began adjacent to Castro Cove (URS 1999). In the early 1900s, the 250-Foot Channel and a navigation channel were dredged from San Pablo Bay along the approximate existing alignment of the Castro Creek channel to provide shipping access to the refinery. In 1957, a dam and dikes were constructed across the mouth of the 250-Foot Channel. Standard Oil Company, a predecessor of Chevron, discharged wastewater treated by an oil water separator into the south side of Castro Cove. After implementation of the Clean Water Act in 1972, all process water was biologically treated prior to being discharged into the 250-Foot Channel. In 1987, discharge of treated effluent to Castro Cove ended when all discharge water was rerouted to the Deep Water Outfall located offshore of Point San Pablo, outside of Castro Cove.

Until the completion of a municipal treatment plant in 1955, the San Pablo Sanitary District discharged untreated sewage into Castro Creek near the confluence with Wildcat Creek. The district discharged treated effluent directly into the cove through a channel which ran along the southern end of the West Contra Costa Sanitary Landfill from 1955 to 1981. These discharges, not associated with Chevron effluent

discharges, ended in 1981 when the district relocated its outfall to a deep-water site offshore of Point Richmond.

Figure 1. Castro Cove Vicinity Map

From 1960 to 1994, Chevron operated a trap and skeet shooting range at the northwestern end of the Richmond refinery on Skeet Hill (URS 2002a). The shooting sites were located in the middle of a leveled area (82 feet in elevation) approximately

250 and 300 feet from the shoreline of Castro Cove. The area of shot deposition in Castro Cove comprises approximately 9 acres or 9.5 percent of the total mudflat area in Castro Cove at low tide. Lead shot (primarily #9 and #8, also #7 ½) is concentrated in the upper six inches of sediment over a 1 ¾-acre area extending between 200 and 425 feet from the shoreline.

1.3 Natural Resource Trustees and Authorities

CERCLA and the CWA authorize federal, state, or tribal authorities to seek monetary damages for injury, destruction, or loss of natural resources resulting from releases of hazardous substances or discharges of oil. The USFWS, NOAA, and the CDFG are the federal and State of California Trustees respectively for the natural resources injured by the releases into Castro Cove. No Tribal trustees have been identified. 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 releases of hazardous substances and oil. The USFWS and NOAA are designated federal trustee agencies 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)). For purposes of coordination and compliance with CERCLA, the CWA, and NEPA, NOAA is designated as the lead federal Trustee. CDFG has been designated as a State trustee for natural resources pursuant to subpart G of the NCP. Additionally, CDFG has State natural resource trustee authority pursuant to Fish and Game Code §§ 711.7 and 1802.

1.4 Natural Resource Damage Assessment Process

Under CERCLA and the CWA responsible parties (RPs) are liable for the reasonable costs of conducting a natural resource damage assessment, as well as for damages for injury to, destruction of, or loss of natural resources. Chevron accepted the Trustees invitation to enter into a Cooperative Natural Resource Damage Assessment Agreement (hereinafter "Agreement") for the Castro Cove releases. The Agreement established a process by which representatives of Chevron and the Trustees coordinated technical activities in the injury determination and quantification stages of the assessment, as well as restoration scaling and planning activities.

Under the Agreement, biologists, toxicologists, resource economists, and other specialists representing the Trustees and Chevron cooperated as a technical working group to analyze data and other information regarding the assessment of injuries to various species and habitats. They also worked together to identify potential actions that would restore or compensate for injuries. This Draft DARP/EA was developed

based upon the cooperative injury assessment and restoration planning efforts between the Trustees and Chevron and their representatives. The determinations and other decisions made by the Trustees, documented in this Draft DARP/EA, reflect consideration of the efforts and input of the technical representatives of the parties. Appendix A and the Administrative Record contain the results of this cooperative effort, including reports on specific topics.

1.5 Coordination with the California Regional Water Quality Control Board

In addition to the Trustees' NRDA efforts, the primary restoration or clean up of contaminated sediments in Castro Cove is being conducted by Chevron with oversight by the RWQCB. In 1998, the RWQCB requested that Chevron prepare a Sediment Characterization Workplan based on the identification of Castro Cove as a candidate toxic hot spot under the Bay Protection and Toxic Cleanup Program. The site investigations conducted at the request of the RWQCB by Chevron between 1999 and 2001 indicated that historical releases from industrial, commercial and municipal operations had affected near surface sediments in the Cove with the primary contaminants of concern being mercury and PAHs. Based on the presence of PAHs, mercury, dieldrin, and selenium in sediments, Castro Cove was added to the State's Clean Water Act (CWA) section 303(d) list of impaired waters in 2002. A Corrective Action Plan (CAP) for sediment remediation was submitted in 2002, and a revised CAP was submitted in 2006. In 2006, the RWQCB issued site cleanup requirements and a water quality certification under Section 401 of the Federal CWA for remediation of sediment contamination in Castro Cove, based on the finding that there was unacceptable risk to ecological receptors (i.e., sediment-dwelling benthic invertebrates). Chevron was considered to be the sole discharger for purposes of the cleanup order. The RWQCB found that implementing the CAP would appropriately remediate the sediments in Castro Cove, and this served as the basis for the Tentative Site Cleanup Requirements (SCRs).

The portion of Castro Cove that is being remediated under the CAP covers about 20 acres in area and is referred to as the area of concern (AOC)[5]. Delineation of the size and depth of the AOC was based on site investigations and characterization overseen by the RWQCB. Site characterization included collecting sediment samples and analyzing them for chemical constituents and testing them for toxicity to fish and amphipods, a small sediment dwelling organism. The chemical and biological data were used to define the area of contamination and to assess the potential risk that the contaminants presented to wildlife. The chemical results indicated that the sediments in south Castro Cove to a depth of two feet below the mud-line were impacted by historical discharges from refinery operations. The risk assessment conducted for the

[5] The use in this document of the term "Area of Concern" is not intended to imply that areas outside of the AOC are not of concern from the standpoint of natural resource injuries. The term derives from existing documents prepared to investigate and address the need for remediation of sediments exceeding certain cleanup thresholds developed by the San Francisco Bay Regional Water Quality Control Board for this site.

RWQCB concluded that the contaminant concentrations in the AOC posed a potential risk to the benthic community (that is, organisms living in the upper layers of the sediments).

To ensure that this upper layer of sediment is removed and that the biological viability of Castro Cove is restored, the CAP requires Chevron to hydraulically dredge the uppermost 2.5 feet of sediments from most of the AOC. In an approximately 1.5-acre area in the southwest corner of the AOC where contaminants are found slightly deeper than two feet, the CAP requires Chevron to excavate sediments to a depth of three feet and then backfill to provide an area of suitable elevation for cordgrass (*Spartina*) restoration. The dredged materials are to be placed at the Number 1 Oxidation Pond (Pond) located within the Refinery, and Chevron is required to construct a protective barrier/cap over the disposed material. The RWQCB adopted a mitigated Negative Declaration after determining that the remediation project would not result in any impacts that were not sufficiently addressed by mitigation measures and included as part of the project.

Chevron is expected to complete the dredging of contaminated sediments in the AOC in 2008; implementation of the other requirements of the CAP is still in progress. With the exception of long-term monitoring requirements, the requirements of the CAP are expected to be completed during 2008, or soon thereafter.

1.6 Coordination with Non-Trustees

Prior to developing the Draft DARP/EA, the Trustees conducted numerous outreach efforts to solicit ideas and concepts for restoration projects that would compensate the public for injuries to natural resources at Castro Cove. The Trustees contacted over 28 community groups and State, federal and local agencies to seek relevant information on potential restoration projects and restoration ideas (see Section 4.5) and met with City of Richmond representatives to inform them of the NRDA at Castro Cove and to solicit input on potential restoration projects. The Trustees also evaluated specific projects identified by the City of Richmond as part of a re-evaluation of the preferred projects carried out based on new information provided by the City.

1.7 Public Participation

An opportunity for the public to comment on the Draft DARP/EA is an integral component of the restoration planning process under the DOI Rule and CERCLA. The Trustees have scheduled a 45-day public review period, during which they invite the public to review this Draft DARP/EA. This comment period opens on November 25, 2008 and closes on January 9, 2009. Comments must be received by the latter 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 (castrocove@noaa.gov).

The Trustees will hold an open house to discuss the Draft DARP/EA with the community and interested members of the public at the Point Richmond Community Center, 139 Washington Avenue in Richmond, California on December 17, 2008 from 4 pm to 7 pm. At this meeting, the Trustees will present a brief overview of the Draft DARP/EA and accept public comment.

Any further information on activities of the Trustees pertaining to the Castro Cove NRDA case will be distributed to those on the Trustees' mailing list, and will be announced through press releases and at the following CDFG and NOAA websites:

- www.dfg.ca.gov/ospr/spill/nrda/nrda_castro.html
- www.darrp.noaa.gov/southwest/castro/index.html

To be placed on the mailing list please contact Natalie Cosentino-Manning at (707) 575-6081 or castrocove@noaa.gov.

1.8 Administrative Record

The Trustees have opened an Administrative Record (Record). The Record includes documents relied upon or considered thus far by the Trustees during the injury assessment and restoration planning performed in connection with the Castro Cove releases. The official Record is maintained by NOAA (Point of Contact: Trina Heard at (562) 980-4070 or by email at Trina.Heard@noaa.gov). The Record Index may be viewed at the websites listed above. A copy of the Record also is on file at the Richmond Library, Main Branch, 325 Civic Center Plaza, Richmond, CA 94804.

2.0 AFFECTED ENVIRONMENT

This section presents a brief description of the physical and biological environment affected by the releases and discharges into Castro Cove, and potentially affected by the preferred projects, as required by NEPA (40 U.S.C. Section 4321, et. seq.). The physical environment most directly affected by the releases is the 20 acres of intertidal mudflats in the AOC and an additional 184 acres of intertidal mudflat and salt marsh habitat within Castro Cove that were contaminated to a lesser extent. This acreage within Castro Cove is a part of a larger embayment comprising approximately 90 square miles of San Pablo Bay in the northern reach of San Francisco Bay. The biological environment includes the benthic community that resides in the intertidal mudflats as well as birds, fish, mammals, shellfish, and other organisms that use intertidal mudflat and salt marsh habitats in San Pablo Bay. Several State and federally-recognized threatened or endangered species are found within the region. 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.). When seeking restoration projects, the Trustees prefer in-kind restoration (e.g., the creation of a new marsh or enhancement of an existing marsh to compensate for lost marsh services) in geographical proximity to the area affected.

2.1 Physical Environment

The San Francisco Bay and the Delta formed by the Sacramento and San Joaquin rivers, create the West Coast's largest estuary. Four distinct subregions comprise the estuary, designated based upon unique features and habitat restoration constraints and opportunities (Goals Project 1999). San Pablo Bay is in the North Bay subregion of San Francisco Bay, downstream of the Carquinez Bridge which forms the western boundary of the brackish Suisun Subregion and upstream of the more saline Central Bay subregion delineated between Point San Pedro and Point San Pablo (see Figure 2).

The patterns of water circulation and salinity in San Pablo Bay are affected directly by the freshwater Delta outflow and runoff from the Napa and Petaluma rivers and diurnal tides from the Pacific Ocean (URS 1999). Two unequal high tides and two unequal low tides occur during each approximate 25 hour period. Winter runoff contains large quantities of sediment which are deposited in the Bay with resuspension of some sediment occurring during the higher spring tides. Tidal and wave action during the remainder of the year provide the energy to separate sediments, retaining heavier material in the higher energy areas of the Bay and depositing finer material in sheltered coves and tidal marshes. Castro Cove, as a shallow embayment in San Pablo Bay, has finer sediments (primarily silts and clays with some fine sand) than control sites in San Pablo Bay, with a higher percentage of sandy material in the Castro Creek channels (URS 1999). Radioisotope dating and bathymetric surveys for Castro Cove

indicate that sediment is accreting at a rate of 0.4 to 0.5 inches per year with higher rates of 3 to 4 inches per year in areas that have been dredged.

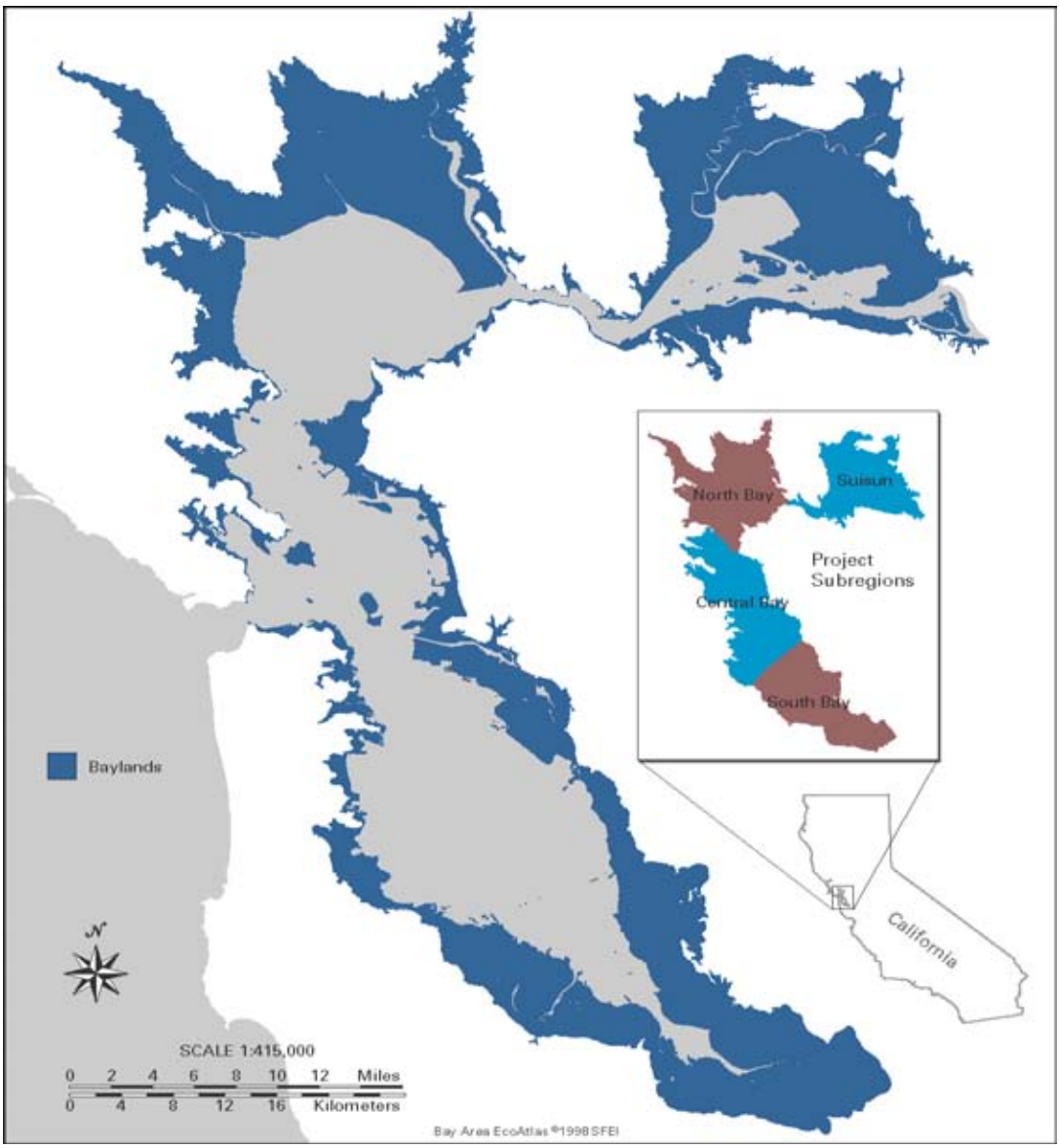

Figure 2. Map of project sub-regions including Suisun, North Bay, Central Bay, and South Bay (Goals Project 1999).

Habitats in San Pablo Bay vary from deep bay marine to mudflats and marsh/slough complexes; although approximately 60 percent of San Pablo Bay is less than 6 feet deep at mean lower low tide. The 80,000 acres of diked and tidal baylands remaining around the perimeter of the Bay and adjacent to rivers are unique features of San Pablo Bay. Baylands refer to the shallow water habitats between the maximum and

minimum elevations of the tides (Goals Project 1999). San Pablo Bay historically contained large tracts of tidal marshes bordered by extensive mudflats. The area between the San Pablo Peninsula and Point Pinole and extending through the length of lower Castro Creek once contained a large tidal marsh bordered by large areas of moist grasslands. An estimated 75 percent of the original tidal wetlands associated with San Pablo Bay have been converted to other uses.

2.2 Biological Environment

San Pablo Bay contains the largest continuous expanse of open shallow-water habitat in the northern estuary and these productive intertidal mudflats and subtidal shallow-water habitats support the phytoplankton and benthic microalgae that provide the basis for the food web in San Pablo Bay. San Pablo Bay provides important spawning and rearing habitat for many marine, estuarine, and anadromous fish as well as marine and estuarine invertebrates. Shorebirds, diving ducks, and bottom-feeding fish are the primary predators to the benthic invertebrates. The largest, over 300 acres, and most contiguous eelgrass (*Zostera marina*) bed in San Francisco Bay can be found within shallow-water areas in San Pablo Bay and provides important habitat for benthic invertebrates, fish, and birds.

San Pablo Bay contains about one-third of the estuary's tidal mudflat habitat. During low tide, most of Castro Cove consists of exposed mudflats (URS 1999). The Castro Creek channel, which is 1 to 2 feet deeper than the surrounding mudflats, also is largely mudflat habitat at low tide. Mudflats provide important foraging habitat for shorebirds. Willet (*Catoptrophorus semipalmatus*), marbled godwit (*Limosa fedoa*), long-billed curlew (*Numenius americanus*), dunlin (*Calidris alpina*), whimbrel (*Numenius phaeopus*), sanderling (*Calidris alba*), and Western sandpiper (*Calidris mauri*) have been observed foraging at the tideline in Castro Cove. When water inundates the mudflats during the twice-daily high tides, migratory waterfowl, gulls (*Larus* sp.), and other water birds may forage or use the cove for roosting or as a staging area, including Western (*Aechmophorus occidentalis*) and Clark's grebe (*A. clarkii*), scaup (*Aythya* spp.), ruddy duck (*Oxyura jamaicensis*), American wigeon (*Anas americana*) and mallard (*Anas platyrhynchos*). The double-crested cormorant (*Phalacrocorax auritus*), nests on the Richmond/San Rafael Bridge and has been observed in Castro Cove (URS 1999). Castro Cove supports macroinvertebrates including dungeness crab (*Cancer magister*), yellow shore crabs (*Hemigrapsus oregonensis*), native oyster (*Ostreola conchaphillia*), bay shrimp (*Crangon franciscorum*), and the oriental shrimp (*Palaemon macrodactylus*), in addition to the benthic invertebrates, such as polychaetes, oligochaetes, bivalves, amphipods, and other crustaceans (URS 2002a). Many midwater and epibenthic fish species such as starry flounder (*Platichthys stellatus*) feed on the invertebrates in Castro Cove. Striped bass (*Morone saxatilis*), northern anchovy (*Engraulis mordax*), longfin smelt (*Spirinchus thaleichthys*), rockfish (*Sebastes* spp.), white sturgeon (*Acipenser transmontanus*), Pacific staghorn sculpin (*Leptocottus armatus*), and shiner perch (*Cymatogaster aggregata*) also may occur in Castro Cove. Fish-eating birds, such as

osprey (*Pandion haliaetus*) and California brown pelicans (*Pelecanus occidentalis*), are also known to forage in Castro Cove.

Tidal salt marsh is considered a sensitive natural community. These vegetated wetlands that are subject to tidal action along the Bay are dominated by Pacific cordgrass (*Spartina foliosa*) and pickleweed (*Salicornia virginica*) depending on elevation within the intertidal zone. On the tidal mudflats around the marsh plain and in low marshes cordgrass predominates, while pickleweed begins to dominate in middle tidal salt marshes at elevations near the mean high water (MHW) and above. The tidal salt marsh in the southeastern portion of Castro Cove along the Castro Creek channel and adjacent to Castro Creek is mostly a middle marsh community dominated by pickleweed with scattered patches of saltgrass (*Distichlis spicata*) and communities of cordgrass located along the edge of the bay (URS 1999). Nesting black-necked stilts (*Himantopus mexicanus*), American avocets (*Recurvirostra americana*), dowitchers (*Limnodromus* spp.), snowy egrets (*Egretta thula*), great egrets (*Ardea alba*), and Canada geese (*Branta canadensis*) have been reported along Castro Creek (URS 1999).

2.3 Species of Concern

There are several species that utilize or could potentially utilize Castro Cove that are of special concern due to their population status. Endangered coho salmon (*Oncorhynchus kisutch*) and Chinook salmon (*O. tshawytscha*), and threatened green sturgeon (*Acipenser medirostris*) and steelhead (*O. mykiss*) could potentially occur in the open water area. The endangered California least tern (*Sternula antillarum*) preys on small fish and often forages in eelgrass beds in the estuary while the threatened Western snowy plover (*Charadrius alexandrinus*) forages in mudflat habitat. The California clapper rail (*Rallus longirostris*) and the salt marsh harvest mouse (*Reithrodontomys raviventris*), both federal- and State-listed endangered species that occupy salt marsh habitats around the Bay, occur in the Castro Cove area (URS 1999). The State-listed threatened California black rail (*Laterallus jamaicensis*) was reported in the area in 1981 (URS 1999). Two State-listed Species of Concern, the San Pablo vole (*Microtus californicus*) which has been observed at the mouth of Wildcat Creek, and the saltmarsh wandering shrew (*Sorex vagrans*) which is known to occur in the San Pablo Creek Marsh, could occur in the salt marsh adjacent to Castro Cove (URS 1999).

3.0 CASTRO COVE INJURY QUANTIFICATION

This section describes the technical working group efforts to quantify the nature, extent, and severity of injuries to natural resources resulting from Chevron's releases to the water and sediment in Castro Cove. It begins with an overview of the data used in assessing the injury to resources in Castro Cove, followed by a description of the methods used to determine and quantify the injuries and lost resource services. Biologists, toxicologists, resource economists, and other specialists representing the Trustees and Chevron cooperated as a technical working group in gathering and analyzing data and other information regarding injuries to various species and habitats. They also worked together to identify potential actions that would restore or compensate for injuries to species and habitats. The timeframe from January 1981 forward to the remediation and post-remedial recovery is the period addressed by the NRDA process. While discharges occurred prior to January 1981, this date represents the beginning of the statutory authority to recover damages for any injuries to natural resources under CERCLA. Remediation of contaminated sediments in the most heavily impacted areas was initiated in 2007, and is largely complete (see Section 1.5 above). Although this was an extensive sediment removal action, not all of the contamination was removed. This is accounted for in the injury quantification.

State and federal scientists and Chevron's consultants used existing chemical analysis and bioassay test results from Castro Cove and San Pablo Bay, modeling, scientific literature, and scientific judgment to arrive at the best estimate of the injuries caused by the releases of hazardous substances and discharges of oil. This analysis recognized that some uncertainty is inherent in the assessment of injuries from chemically impacted sites such as Castro Cove. While the Trustees understand that collecting more information would likely reduce some of the uncertainties in the estimate of injuries, they have sought to balance the desire for improved injury estimates with the reality that further study would delay the implementation of restoration projects and substantially increase assessment costs, and they recognize that, given the conservative input estimates utilized in the Habitat Equivalency Analysis, more certainty in those data would be unlikely to produce any significant difference in the nature or scale of the restoration actions.

Natural resources may support recreational activities or other public uses potentially affected by contamination. The Trustees considered potential recreational uses including fishing, swimming, wildlife viewing, and boating, but found no information indicating services of this nature have been lost or diminished due to contaminants released at the site.

No health advisories exist with respect to swimming or any other contact recreational activities in Castro Cove. Public access to the Cove is extremely limited because the surrounding upland is largely comprised of private industrial properties. Boating access to the inner portion of the Cove is inhibited by extremely shallow water and

soft sediments. Therefore, there is little likelihood of lost recreational use of surface waters due to the contamination at the site.

Based on this situation, the Trustees concluded that there was no reason to conduct a separate analysis of recreational losses and assumed that restoration actions addressing lost habitat services would also address any un-quantified human use losses that may have occurred as a result of contamination at the site.

3.1 Approach to Injury Assessment

Figure 3 provides an overview of Castro Cove and the sampling sites used to evaluate the injury. Based on an analysis of sediment samples, the technical working group determined that the inner half of the cove was the area most significantly impacted by the releases. Levels of contamination in samples collected in the outer half of the cove were not significantly different from background contamination levels in other parts of San Pablo Bay. The technical working group divided the impacted area in the inner half of the cove into two sections: (1) the Area of Concern (AOC) delineated by the RWQCB; and (2) the non-AOC. The AOC, approximately 20 acres where sediment removal has occurred, contains tidally-influenced mudflats. The non-AOC includes tidally-influenced mudflats, sections of saltmarsh, as well as lower Castro Creek (Figure 3). Additional details are presented in Section 3.2.

Castro Cove was mapped, and polygons were delineated by use of a tessellation process that divided the cove into bounded areas, each containing a single sediment sample in the center (Figure 3). A tessellation is a collection of polygons fit together such that they fill the plane with no overlaps or gaps. All sediment data were taken from existing reports (URS 1999; 2002b). The data set was quite extensive since Castro Cove has had numerous rounds of investigation, some of them related to the remediation process overseen by the RWQCB. Mercury and total polycyclic aromatic hydrocarbon (TPAH) concentrations in sediment samples were highly correlated; the Trustees used TPAH for the primary injury assessment to benthic invertebrates and evaluated additional risk to vertebrates from mercury and lead shot as described below.

The primary injury analysis utilized paired Castro Cove TPAH sediment concentrations and amphipod bioassay results (i.e., percent mortality). The Trustees compared these two sets of data in a manner similar to one used to predict amphipod toxicity (either the probability of toxicity or the magnitude of toxicity) from sediment chemistry (Field et al. 2002). This comparison then provides a means to characterize toxicity at sampling stations where only sediment chemistry data are available. The TPAH concentrations in the sediment samples from each polygon were used to estimate the severity of the contamination. The magnitude of the TPAH contamination was then used to determine the degree of injury to the natural resource services. An area weighting factor was applied proportionate to the size of the polygons to account for the areal extent of contamination in the injury estimate.

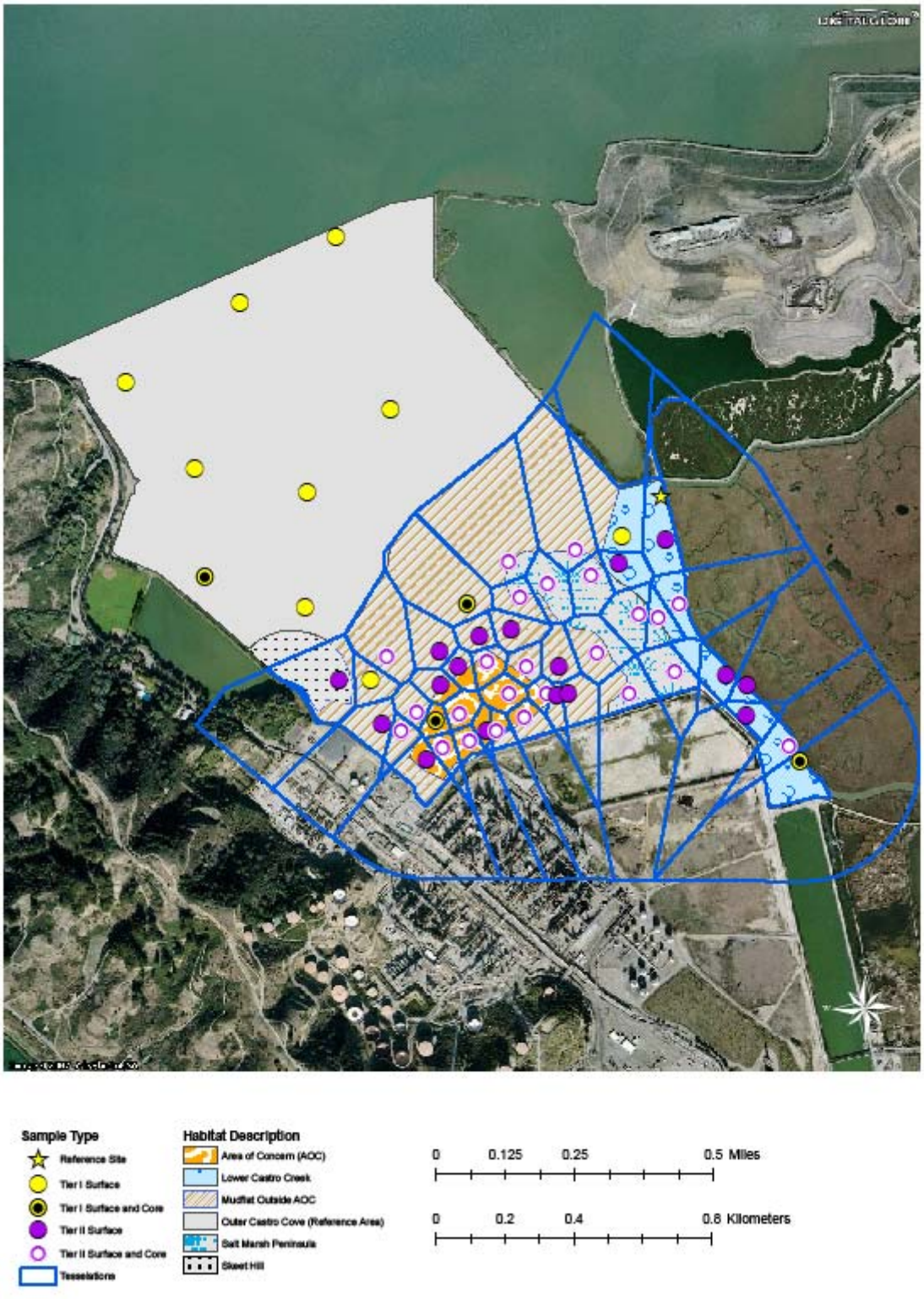

Figure 3. Castro Cove sediment sampling locations and tessellation polygons.

The Trustees used the estimates of amphipod mortality as the measure of total ecological injury and lost services in a direct 1:1 manner. Thus, amphipod injury served as a proxy for injuries throughout the ecological food web. The technical working group considered this appropriate and a conservative measure of service loss to the food web since benthic invertebrates such as amphipods form the base of the food web for other aquatic organisms and wildlife that depend upon them. Additional details are presented in Section 3.3.

In addition to the amphipod mortality evaluation, a food chain model estimated risk to resident birds and small mammals in the salt marsh (i.e., the California clapper rail and salt marsh harvest mouse). Since mercury is a persistent contaminant that bioaccumulates and can increase to harmful levels up the food chain, a food chain model examined whether there was sufficient risk present to justify additional injury quantification for the effects of mercury on birds and mammals in Castro Cove. Additional details are presented in Section 3.4.

As fish utilize the Castro Cove habitat, a separate risk assessment for fish evaluated whether sufficient risk was present to justify a separate injury analysis for these resources. The risk assessment addressed both TPAHs and mercury, and is described in greater detail in Section 3.5.

Lastly, the technical working group conducted an evaluation of the risk to shorebirds and waterfowl from ingestion of lead shot in the sediment. Shot, resulting from historical skeet range activities, is present in the sediments in an arc-like pattern emanating from Skeet Hill and extending into Castro Cove's mudflat habitat (Figure 3). An assessment of the risk of lead shot ingestion to sediment-probing shorebirds and waterfowl determined whether any additional injury quantification was warranted for this receptor group. This assessment is described in greater detail in Section 3.6.

3.2 Chemistry

Sediment data collected from previous investigations indicated that the primary contaminants of concern that Chevron had contributed to the sediments of Castro Cove were mercury and PAHs. These were also identified by RWQCB as the primary chemicals of interest in determining Chevron's cleanup requirements for Castro Cove. The chemistry results from the *Draft Sediment Characterization and Tier I Ecological Risk Assessment for Castro Cove* (URS 1999) and the *Tier II Sediment Characterization and Ecological Risk Assessment Castro Cove* (URS 2002b) were used along with bioassay results to assess the extent of injury to the benthic macroinvertebrate infauna living in the mudflat habitat of Castro Cove. Copies of these documents are available in the Administrative Record, discussed in Section 1.8.

Concentrations of mercury and PAHs were compared to background levels in San Pablo Bay using the San Francisco Estuary Institute's Regional Monitoring Program

(RMP) dataset (Appendices A-1a and A-2c). This step corrected for concentrations of these chemicals in Castro Cove sediments due to sources other than Chevron. Mercury and TPAH concentrations were highly correlated. For scaling purposes, the Trustees selected TPAHs as the indicator for injury assessment. Concentrations of TPAHs above background were used to determine the degree of injury to attribute to Chevron within each polygon. If sample results from the 0 to 1 foot depth did not exist, surface sample data were used. The method for determining the degree of injury for each sample is described in the following section.

3.3 Amphipod Bioassay Results

A standardized laboratory procedure known as a bioassay was conducted to evaluate the toxicity of Castro Cove sediments to aquatic benthic organisms. A bioassay with the amphipod *Eohaustorius estuarius* was performed in some of the sediment samples taken from Castro Cove (URS 2002b). The results of these amphipod bioassays were used along with the chemistry results to create a dose-response curve that predicts the percent mortality at a given concentration of TPAH in the sediment (Figure 4). This curve is referred to as a Logistic Growth Model (LGM) based upon the mathematics of its derivation.

Shallow aquatic habitats such as Castro Cove provide many types of natural resource services, including biological productivity and food web services, breeding and nesting sites, shelter from predators, roosting grounds for migratory birds, and other functions. Nevertheless, for this case, the Trustees assumed the overall degree of natural resource injuries and lost services in Castro Cove to be equal to the degree of amphipod mortality predicted by the LGM curve. Thus, amphipod mortality associated with sediment contamination is used as a proxy for a broad range of natural resource injuries and lost services, including higher-level organisms (i.e. birds and fish) and other non-food web services. This was done because while there was a quantitative estimate of risk to birds and fish in Castro Cove, there was no useful quantitative metric for evaluating these injuries in the Habitat Equivalency Analysis (HEA), i.e. to convert them to Discounted Service Acre-Years (DSAYs) for the HEA (see Appendix A-6), and the fundamental role of the benthic community in the health and productivity of the entire ecosystem made the use of a conservative estimate of impacts on that community a reasonable surrogate for impacts on the entire system.

The LGM curve served as a tool for predicting amphipod mortality which was then used to determine the level of injury. For each polygon the TPAH chemistry results were used to determine the injury level by applying the mathematical relationship represented by the LGM curve. Figure 4 shows this curve as the dashed line (see also Appendix A-2d).

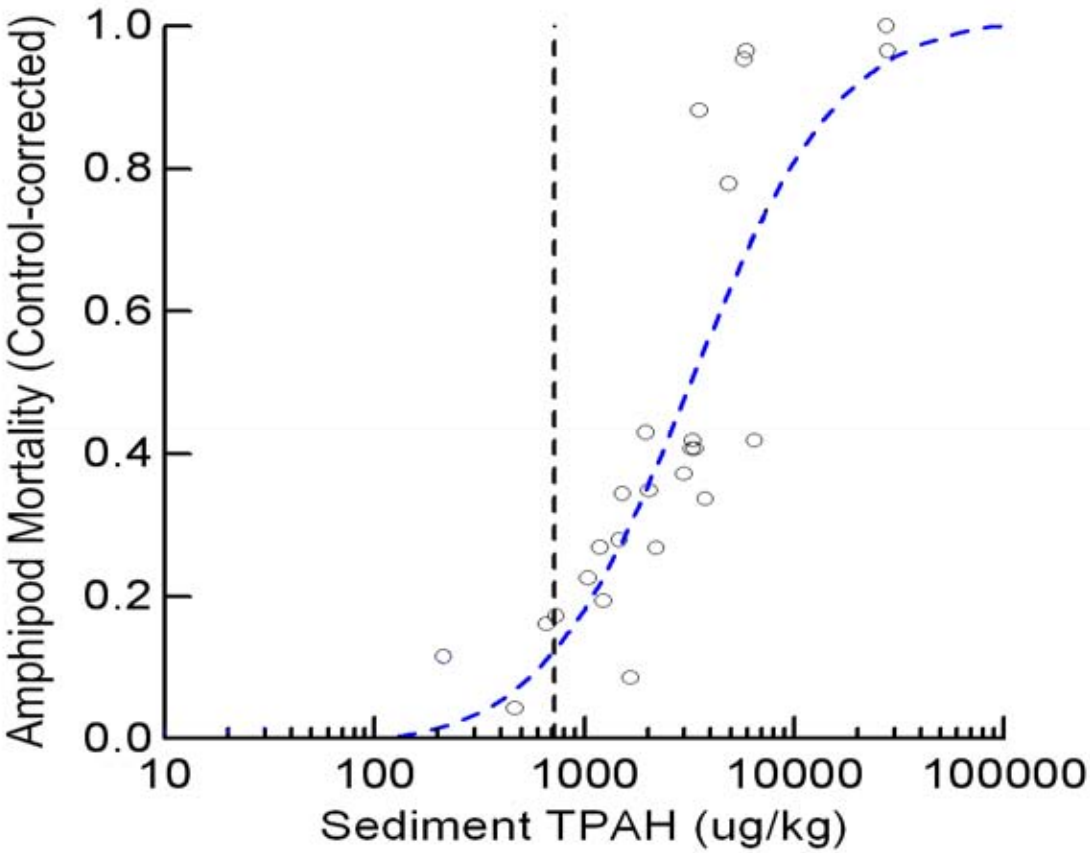

Figure 4. Logistic growth model for amphipod toxicity test responses (mortality) to TPAH concentrations. The vertical dashed line corresponds to the regional background concentration based on mean TPAH concentrations from the RMP for San Pablo Bay.

3.4 Food-chain Modeling Results for Selected Castro Cove Receptors

A food chain model was constructed to estimate risk to the California clapper rail and the salt marsh harvest mouse as these organisms are assumed to inhabit the salt marsh habitat adjacent to Castro Cove year round. Risks to the willet and scaup were assessed using the food chain model for exposures occurring in the mudflat habitat (Appendix A-3b). These analyses were performed based on mercury exposure, as it has the capacity to bioaccumulate in the food chain resulting in harm to higher-level organisms and particularly their offspring. Environmentally protective assumptions (e.g., 100 percent bioavailability of mercury, a range of bioaccumulation factors (BAF), and sediment concentrations based on the upper 95 percent value), were used in estimating exposures as a means of addressing uncertainties and erring on the side of over-estimating injuries in this analysis. The results generated several hazard quotients (HQs) below one and a few HQs above one (Table 1); HQs > 1 indicate potential risk because the estimated dose to the organism exceeds either a Low TRV

(toxicity reference value) considered safe or a High TRV associated with adverse effects. The HQ results for the California clapper rail, salt marsh harvest mouse, willet, and scaup were low enough that the Trustees considered the "reasonable worst case scenario" described by the LGM prediction of injury sufficient to incorporate the estimated injuries based on food chain modeling. Thus, the Trustees assumed there was no additional injury beyond that described by the process in Section 3.3 and applied to the Castro Cove ecosystem.

Table 1. Dose and Hazard Quotient Estimations for Select Castro Cove Receptors, using the Upper 95% Surface Sediment Concentrations and Low and High Toxicity Reference Values (DTSC 2000).

Species/ Location	**Estimated Hg Dose BAF = 1.66* (mg/kg/day)**	**Estimated Hg Dose BAF = 0.187** (mg/kg/day)**	**Hazard Quotient BAF = 1.67**		**Hazard Quotient BAF = 0.187**	
			TRV_{Low}	**TRV_{High}**	**TRV_{Low}**	**TRV_{High}**
California Clapper Rail/Salt Marsh	0.1090	0.0217	2.79	0.61	0.56	0.12
Salt Marsh Harvest Mouse/Salt Marsh***	0.2457	0.0305	0.983	0.061	0.124	0.008
Willet/Mud Flat	0.1903	0.0413	4.91	1.06	1.06	0.23
Scaup/Mud Flat	0.1739	0.0250	4.49	0.97	0.64	0.14

*Bioaccumulation Factor is an average for San Pablo Bay sites in the RMP.
**Mean BAF from clams collected from offshore areas at Mare Island (Tetra Tech EM Inc. 2000).
***A BAF of 1.66 was assumed for the vegetation ingested by the salt marsh harvest mouse, as 100 percent of the diet is vegetable matter.

3.5 Fish Injury Assessment

The technical working group evaluated potential injuries to fish in Castro Cove using the English sole (*Parophrys vetulus*) as the surrogate species. This species is a bottom-dwelling flatfish that has been extensively studied for effects from exposure to PAHs. In the absence of site-specific data on fish injuries for Castro Cove, the technical working group relied on service loss assumptions for English sole that were developed for a natural resource damage assessment for the Hylebos Waterway in Commencement Bay, Washington State (NOAA 2002). Sediment concentrations of TPAHs in Castro Cove were compared to sediment concentrations of TPAHs for which thresholds of assumed service losses were developed for the Hylebos NRDA case. The results of this analysis suggest some potential for injuries to fish from TPAHs in Castro Cove (Appendix A-4). The degrees of service losses derived using

the Hylebos assumptions were generally lower at corresponding sediment concentrations than those derived using the LGM approach, discussed above.

To assess potential injuries to fish from mercury, the technical working group calculated HQs using four different TRVs (Appendix A-4). The TRVs were developed based on literature values for no observed adverse effects levels (NOAELs) for growth, reproduction, and mortality to adults and embryos. A review of the effects attributable to mercury in fish shows that neurological and reproductive systems tend to be affected to the greatest degree relative to other organs or functions. Table 2 shows the results of this analysis, with HQs ranging from 0.53 to 133.5 in the mudflat habitat, 0.31 to 78.5 in the salt marsh habitat, and 0.25 to 63 in the creek channel area. These results suggest some potential for injuries to fish from mercury in Castro Cove.

Since the LGM curve estimates service losses equal to or greater than those predicted by other examinations of potential fish effects, as with the determination made for the food chain modeling results for wildlife, the Trustees considered the degrees of service losses predicted by the LGM approach sufficient to incorporate the estimated injuries to fish from TPAHs and mercury.

Table 2. Hazard Quotient Risk Characterization Based on a Range of Tissue-Specific TRVs in Fish

Species: Life Stage/Chronic Effect	**TRV (µg-Hg/g-tissue)**	**Hazard Quotient**		
		Mudflat	**Salt Marsh**	**Creek Channel**
Rainbow trout: Adult/Mortality	NOAEL: 5 (McKim et al. 1976)	0.53	0.31	0.25
Rainbow trout: Eggs & Larvae/Mortality	NOAEL: 0.02 (Birge et al. 1979)	133.5	78.5	63
Juvenile & Adult fish/Growth & Reproduction	NOAEL: 0.20 (Beckvar et al. 2005)	13.35	7.85	6.3
Fathead Minnow: Larvae/Growth & Reproduction	NOAEL 0.32 (Snarski and Olson 1982)	8.34	4.91	3.94

3.6 Lead Pellet Ingestion Risk to Shorebirds and Waterfowl

The portion of Castro Cove contaminated with lead shot from an historical skeet range known as Skeet Hill was investigated for potential risk to shorebirds and diving ducks. Based on previous work done at the Alameda Point Skeet Range, two diving duck species were selected; the scaup and the surf scoter (*Melanitta perspicillata*) (Battelle and ENTRIX 2002). Based upon previous work done for Castro Cove, the willet was selected as the shorebird for this evaluation. The willet is relatively abundant in Castro Cove and has probe-feeding characteristics well suited to represent a relatively high (protective) exposure potential (URS 2002a).

The analysis used sets of less-environmentally protective and more-environmentally protective assumptions to create a risk range for these birds. The probabilistic risk estimates represent the probability of exceeding the no observed adverse effects level (NOAEL), which is three No. 8 lead shot for these birds. The results for risk to the willet ranged from 7.9×10^{-6} to 1.6×10^{-3}. Therefore, with the more environmentally protective or reasonable maximum exposure assumptions, the probability of a willet ingesting greater than the NOAEL number of shot is less than or equal to 1.6×10^{-3} (i.e., between 1 and 2 in 1,000 individuals). For the waterfowl (combining the scoter and scaup) the risk range calculated was 1.9×10^{-9} to 4.1×10^{-5} using the less and more environmentally protective assumptions, respectively (Appendix A-5). For waterfowl, the probability of ingesting greater than the NOAEL number of shot, assuming the maximum exposure parameters, is less than or equal to 4.1×10^{-5}, or 1 in 41,000.

As with the decision based on the food chain modeling results, the Trustees considered the "reasonable worst case scenario" described by the LGM prediction of injury sufficient to incorporate the estimated injuries to shorebirds and waterfowl from ingestion of lead shot in Castro Cove.

3.7 Quantification of Natural Resource Injuries

Quantification of injuries relied on a service–to-service restoration-based approach. The Trustees sought to identify appropriate restoration projects to compensate for the interim losses between 1981 (the commencement date under CERCLA) and projecting forward 100 years, assuming that some of the injury (to a lesser degree) will persist. For this task, the technical working group agreed to use Habitat Equivalency Analysis (HEA). Used both in California and elsewhere in the United States, HEA is a commonly used method of scaling injuries and restoration across space and time. The HEA method is divided into two main tasks: the debit (or injury) calculation and the credit (or restoration) calculation. The debit calculation involves determining the amount of natural resource services that the affected habitats would provide had they not been injured. The unit of measure in this case is discounted service-acre-years, which incorporates both the time and space of resource services provided by the habitat. 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. Restoration scaling is discussed in Section 3.9 and scaling of the tentatively preferred restoration projects is discussed in Section 4.6.

3.8 Summary of Injury

Using TPAH concentration inputs to the LGM for amphipods, the technical working group estimated that the overall average degree of injury and lost services due to hazardous substances and oil from the Chevron refinery was 60.0 percent in the AOC and 17.5 percent in the areas having contamination above ambient levels outside of the

AOC. No injury was attributed in the mudflat areas of the outer cove where TPAH levels were similar to background concentrations in other parts of San Pablo Bay. No additional injury (beyond that encompassed in the LGM-based estimate) was estimated for birds, mammals, or fish based on the food chain model results and other analyses. Similarly, no additional injury was estimated for lead shot ingestion by birds near the Skeet Hill area. The Trustees believe that the injury levels estimated using the LGM method are sufficient to indirectly incorporate the potential injuries to other natural resources that may have been impacted by the contaminated sediments in Castro Cove.

Appendix A-6 contains a summary of the injury inputs to the HEA calculations. For quantification purposes, the service loss was divided into two areas: the AOC (19.7 acres) and the non-AOC. The non-AOC (184.5 acres) is less injured and outside of the cleanup area so the Trustees assigned the same level of service loss from 1981 through 2106. The AOC is significantly injured from 1981 though 2008, with the greatest level of lost services occurring due to the excavation associated with the remediation. However, after the remediation actions, it is assumed that recovery will take 5 years, the AOC will recover to the level of services provided by the non-AOC, and that it will provide services at this level through 2106. A total of 2,958 discounted service-acre-years of intertidal and shallow subtidal habitat was calculated as the resource services debt owed to the public by Chevron for the contaminant-induced reduction in natural resource services using these input parameters (see Figure 5).

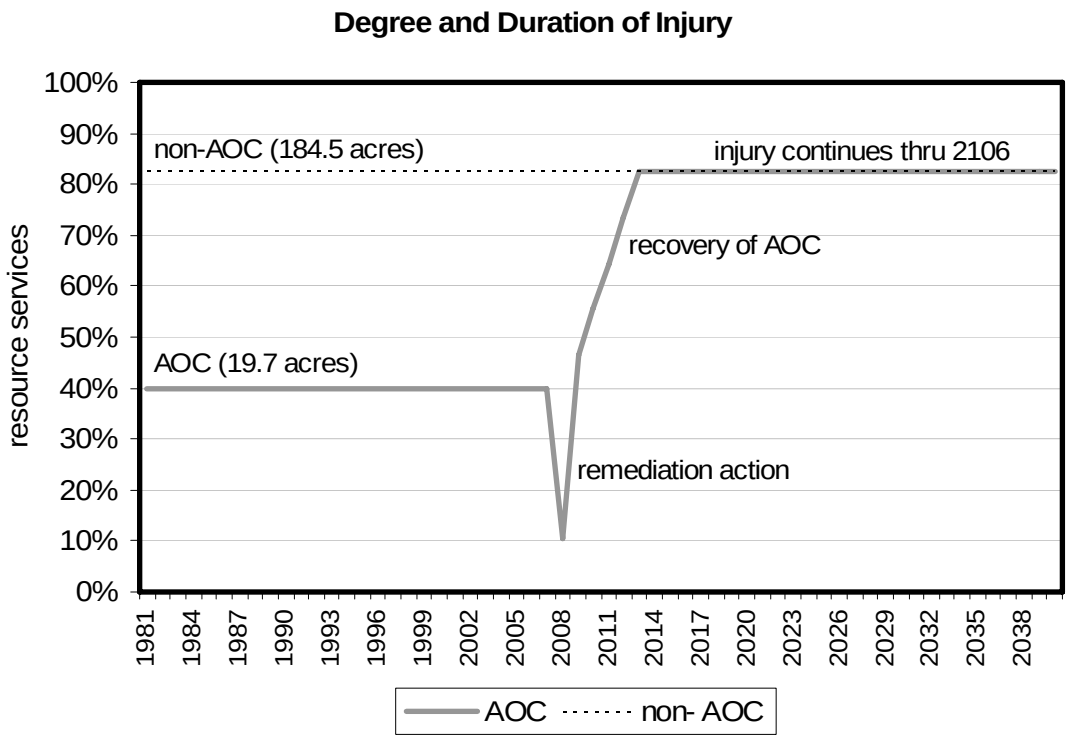

Figure 5. Castro Cove injury quantification trajectory for the degree and duration of lost natural resource services

3.9 Scaling Restoration

The process of "scaling" a compensatory restoration action involves determining the size of the restoration action(s) needed to provide resource and service gains equal to the value of interim losses due to the release of hazardous substances (NOAA 1997; 1999). Because the duration of the injury differs from the lifespan of the restoration action(s), equivalency is calculated in terms of the present discounted value of services lost due to resource injuries and gained due to compensatory restoration. Restoration actions must restore the equivalent of the injured resources by providing resources and services of the same type and quality and of comparable value as those injured.

The details of the HEA used by the Trustees to compare the lost natural resource services resulting from the Castro Cove contamination (debit calculation) to the anticipated natural resource service benefits of potential restoration projects (credit calculation) is presented in Appendix A-6. Based on the Trustees' best estimates of the timeframes for realizing the project benefits of the preferred restoration projects and the anticipated degree of improvements in habitat values, the Trustees concluded that approximately 203 acres of tidal wetlands habitat restoration are needed to offset the loss of services calculated in the injury assessment.

4.0 RESTORATION PLANNING AND ALTERNATIVES ANALYSIS

The goal and strategy of this restoration plan is to identify and select appropriate habitat restoration actions to compensate for the loss of natural resource services provided by intertidal, shallow subtidal, and saltmarsh habitats in Castro Cove that have been injured by releases of hazardous substances and discharges of oil. This chapter addresses the restoration strategy, the process for development of restoration alternatives and projects, the evaluation of the No-action Alternative, the criteria used to evaluate the restoration projects, the identification of potential restoration projects, evaluation of restoration projects and project types, and cumulative impacts of the preferred alternative projects.

4.1 Restoration Strategy

The Trustees achieve restoration objectives by returning injured natural resources to their baseline condition and by compensating for any interim losses of natural resources and services during the period of recovery to baseline (See Section 1). The DOI Rule and NEPA provide that Trustees consider a range of possible alternatives and actions that restore, rehabilitate, replace, or acquire the equivalent of the injured natural resources and lost services. Restoration activities can range from natural recovery, to actions that prevent interference with natural recovery, to more intensive actions expected to return injured natural resources and services to baseline faster or with greater certainty than natural recovery. Restoration also may restore resources or services beyond baseline conditions as a means of compensating for interim losses.

Restoration actions are either primary or compensatory. Primary restoration actions are taken to return injured natural resources and lost services to their respective baseline conditions. If the release of a contaminant impairs the ability of organisms to reproduce, actions that restore the injured organisms' reproductive function to the level that would exist were it not for the release are considered primary restoration. An example of a primary restoration action is the removal of the contamination from the organisms' environment, which in this case, involves removal (remediation) of bay mud from approximately 20 acres in Castro Cove (see Section 1.5).

Compensatory restoration actions are taken to compensate for interim losses of natural resource services pending complete recovery to baseline conditions. Under the DOI Rule, compensatory restoration claims are recovered as claims for "compensable value." The regulations describe these damages as, "The compensable value of all or a portion of the services lost to the public for the time period from the discharge or release until the attainment of the restoration, rehabilitation, replacement, and/or acquisition of the equivalent of the resources and their services to baseline" (Title 43 C.F.R. Part 11.80).

The remediation of the most highly contaminated sediments in Castro Cove, initiated by Chevron in 2007, constitutes primary restoration of injured resources. The Trustees have not identified any other primary restoration actions that could be taken to accelerate recovery of natural resources within Castro Cove to their baseline conditions. Thus the Trustees have focused efforts on identifying compensatory restoration actions to offset interim losses of natural resource services that resulted from the contamination in Castro Cove.

The Trustees' restoration strategy in this case is to identify and implement projects that improve the ecological function of habitats in San Pablo Bay (see Figure 2) that are not fully functional at present, and that are identical or similar to habitat injured in Castro Cove (intertidal mudflat, salt marsh, and shallow subtidal habitat). Therefore, restoration projects that were beneficial to the San Pablo Bay ecosystem were considered. In addition, the Trustees seek to optimize restoration benefits through coordination with other resource management and restoration programs in the region (i.e., to take advantage of regional partnerships to gain efficiency and avoid duplication of effort).

4.2 Development of Restoration Alternatives and Projects

In accordance with the DOI Rule, the Trustees identified a reasonable range of restoration projects, evaluated them against specific criteria, and identified the preferred alternative projects. The Trustees first identified a large number of diverse restoration projects (some only conceptual, others ready for implementation) capable of serving as compensatory restoration for the injured natural resources and/or services. The Trustees then evaluated these projects against a set of State and federal criteria (Section 4.4). As part of the effort to develop restoration alternatives and projects, the Trustees consulted with local scientists, several public and private organizations, and State, federal and local governments to get their perspectives on the benefits and feasibility of various types of projects. These efforts were important in assisting the Trustees in identifying restoration actions or projects that are feasible, have strong net environmental benefits, and meet restoration requirements to compensate for injuries resulting from Chevron's releases and/or discharges into Castro Cove. The Trustees have proposed a preferred restoration alternative composed of two projects in this draft DARP/EA and, after considering public comment, will make a final selection of restoration actions to address resource injuries and service losses.

Some of the restoration projects considered by the Trustees for this case would provide natural resources and services equivalent (i.e. of the same type, quality, and value) to those injured; these are referred to as "in-kind" restoration projects. Other projects considered would provide natural resource services that are in some ways similar but not equivalent in type, quality, and value to those injured. The Trustees preferentially seek in-kind restoration (e.g., the creation of a new marsh or enhancement of an existing marsh to compensate for lost marsh services) in

geographical proximity to the area affected. Increased benefits and efficiency may be achieved by addressing several injured resources and/or lost services with a single restoration project.

4.3 Evaluation of the No-action Alternative (No project)

NEPA requires the Trustees to consider a No-action Alternative. Under this alternative, the Trustees would take no direct action to restore injured natural resources or compensate for lost services pending environmental recovery. Instead, the Trustees would rely on natural processes for recovery of the injured natural resources.

Natural recovery of the injured resources would occur over time (and in this case will occur more rapidly because of the remedial action). However, natural recovery cannot compensate the public for interim losses suffered during the time between injury and complete recovery. Accordingly, should the Trustees choose natural recovery as the means to provide compensatory restoration, the public will go wholly uncompensated for interim losses. Given the Trustees' responsibility to seek compensation for interim losses; the availability of technically feasible; cost-effective; and ecologically beneficial restoration options; and the Trustees' determination that compensable interim losses exist in this case, the Trustees do not propose to select the No-action Alternative.

4.4 Criteria Used to Evaluate Restoration Projects

Under NRDA regulations, the Trustees identify preferred and non-preferred restoration projects based on State and federal criteria. Projects must be consistent with the Trustees' goal to restore, rehabilitate, replace, enhance, or acquire the equivalent of the injured resources and resource services. There are several criteria that the Trustees used to make these decisions, described below. Should additional projects or information on the projects already evaluated in this draft be submitted to the Trustees during the public review period, the additional projects and the additional information will be considered and evaluated using the same criteria.

4.4.1 First Tier Screening Criteria

In order to pare down the large list of potential restoration projects, and focus information gathering efforts on the most likely alternative projects, the Trustees screened the potential projects against two threshold criteria: 1) relationship of the proposed restoration project to the injured resources and/or services and 2) proximity of the restoration action to the affected area. These two criteria were used because they reflect important project attributes critical to the Trustees' restoration goal and could be applied to all restoration projects and concepts without the need to gather detailed, extensive information. These two primary screening criteria are defined below.

1. *Relationship to Injured Resources and/or Services***.** Projects that restore, rehabilitate, replace, enhance, or acquire the equivalent of the same or similar resources or services injured by the releases are preferred to projects that benefit other comparable resources or services. This criterion considers the types of resources or services injured and the connection between restoration project benefits and the injured resources. Thus, the Trustees evaluate the habitat type being enhanced or created and the potential relative benefits of that habitat for injured resources or service losses.

2. *Proximity of a Project to the Affected Area*. Implementing restoration actions near the affected area increases the probability that the same resources that were injured benefit from the restoration project(s). The Trustees decided to limit consideration of projects to those in the North Bay Subregion of San Francisco Bay, i.e. along the North East Bay (Alameda County) and San Pablo Bay and Suisun shores (Contra Costa and Solano Counties). Projects in these areas would benefit many species of fish and birds that utilize the San Pablo Bay ecosystem, of which Castro Cove is a part.

4.4.2 Second Tier Screening Criteria

After the first tier screening, a second set of screening criteria was applied to the remaining restoration projects and project locations. The criteria used to rank these projects were those that served to emphasize project differences and determine which projects would provide the greatest resource benefits in the most efficient manner.

3. *Technical Feasibility*. This criterion considers site-specific factors that may influence a project's potential success, such as whether a project is technically and procedurally sound, utilizes proven methods, involves sufficient acreage that is suitable and available for project implementation, and whether there are potential institutional or legal constraints.

4. *Cost Effectiveness*. This criterion considers the cost associated with implementation of the restoration project relative to expected resource and service benefits. Projects that provide similar benefits but that are less expensive are preferred.

5. *Time to Provide Benefits*. This criterion considers the time it will take for benefits to be provided to the target ecosystem. A more rapid provision of benefits is preferred.

6. *Duration of Benefits*. This criterion considers the expected duration of project benefits, favoring projects whose benefits can be protected for the long term or in perpetuity.

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

8. *Multiple Resource and Service Benefits*. The extent to which the project benefits more than one injured natural resource or resource service is considered favorably.

9. *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.

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

11. *Likelihood of Success*. The potential for success and the level of expected return of resources and resource services is considered. 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 are also considered.

4.5 Identification of Potential Restoration Projects

In initiating the restoration planning process for injuries sustained in Castro Cove by the Chevron releases, the Trustees limited the geographic scope of the potential restoration projects that they would consider to those in the North Bay Subregion of San Francisco Bay, i.e. along the North East Bay (Alameda County) and San Pablo Bay and Suisun shores (Contra Costa and Solano Counties). A list of potential restoration projects was created from those described by the San Francisco Bay Joint Venture (www.sfbayjv.org), the Baylands Ecosystem Habitat Goals Document (Goals Project 1999), and the San Francisco Bay Wetlands Tracker (http://www.wetlandtracker.org/). To supplement this list, the Trustees contacted over 28 community groups, universities, consultants, State, federal and local agencies that might have relevant information concerning these projects or additional restoration ideas including those listed in Table 3. Potential projects were then grouped by habitat type: tidal wetlands, subtidal, and stream/riparian (Table 4).

In a July 18, 2007 letter the City of Richmond suggested that the Trustees consider four additional restoration concepts. These included an expansion of the Breuner project beyond the tidal wetlands restoration portion considered by the Trustees, creosote piling removal from certain locations along the Richmond waterfront, restoration of historical portions of Castro Cove marsh that have been filled and developed for many years, and restoration of wetlands habitat in Hoffman marsh. These are evaluated in Section 4.6.

Table 3. Parties Contacted for Information on Potential Compensatory Restoration Projects for Injuries to Castro Cove

Parties Contacted	
California Coastal Conservancy Spartina Project	Mactec
California Department of Fish and Game	Natural Heritage Institute
City of El Cerrito	Port of Richmond
City of Richmond	Restoration Design Group
Contra Costa County Resource Conservation District	San Francisco Bay Conservation and Development Commission
Cooper Crane	San Francisco Bay Joint Venture
Creek Keepers	San Francisco Bay Trails
Ducks Unlimited	San Francisco State University
East Bay Regional Park District	Save San Francisco Bay Association
East Shore State Park	Sonoma Land Trust
Friends of Five Creeks	The Watershed Project Group
Friends of Pinole Creek	Wetlands and Water Resources
Kleindfelder	U.S. Fish and Wildlife Service
Ma'at Youth Academy for Environmental Leadership	Urban Creeks Council

Table 4. Potential Restoration Projects to Compensate for Injuries to Castro Cove

Project	County
Stream/riparian projects	
Wildcat Creek 1	Contra Costa
Wildcat Creek 2	Contra Costa
San Pablo Creek	Contra Costa
Pinole Creek	Contra Costa
Tidal wetlands projects	
Pacheco Marsh	Contra Costa
McNabney Marsh	Contra Costa
Breuner Marsh	Contra Costa
Baypoint Marsh	Contra Costa
Wildcat Marsh	Contra Costa
Cullinan Ranch	Solano
Hoffman Marsh	Alameda
Historical Castro Cove Marsh	Contra Costa
Spartina eradication • Multiple locations	Contra Costa
Shallow subtidal projects	
Eelgrass seeding • Breuner • Point Orient	Contra Costa
Oyster restoration • Breuner • Point Orient	Contra Costa
Creosote removal • Terminal 4 • Red Rock warehouse • Richmond bridge	Contra Costa

Available information about all of the restoration projects was gathered, including descriptions of the projects, the sizes and types of habitats to be restored, the current land use/ownership, the resources/services to be restored or benefited, the expected time to implementation, the expected time to achieve full benefits, the status of project design and environmental documentation, the status of permitting, the cost per acre benefitted, and public involvement. Sixteen projects, including those suggested by the City of Richmond, were initially examined. Fourteen were located within Contra Costa County, one was located in the North East Bay (Alameda County) and one was located in Solano County (Table 4).

4.6 Evaluation of Restoration Projects

From the original sixteen potential projects, the twelve projects that address tidal and shallow subtidal habitats were found to best meet the first tier screening criteria (Section 4.4.1). These were the eight tidal wetlands restoration projects, the Invasive Spartina Project, and three subtidal projects (eelgrass seeding, native oyster restoration, and creosote piling removal). Since a reasonable number of intertidal and subtidal projects were available for evaluation that provide resources "of the same type and quality, and of comparable value" as the injured habitats in Castro Cove (NOAA 1995) and were within reasonable proximity to the site, the Trustees screened out from further consideration the four stream and riparian restoration projects. The natural resource services that these latter four projects would provide, while ecologically valuable and addressing some of the injured resources and lost services of the case, do not meet the first tier screening criterion 1 as well as the tidal wetland and subtidal projects.

In the process of gathering more detailed information about the Invasive Spartina Project, the California State Coastal Conservancy informed the Trustees that this project was fully funded; therefore, the Invasive Spartina Project was dropped from further consideration. The McNabney Marsh site was also dropped from consideration because funding was no longer needed. Thus ten projects (seven tidal wetlands projects and three subtidal projects) underwent more detailed evaluation.

Table 5 summarizes the Trustees' evaluation of potential restoration projects based on the evaluation criteria. As a group, the tidal wetlands restoration projects best satisfied the Trustees' threshold evaluation criteria. A detailed discussion and evaluation of each project is provided later in this Section.

In the event the Trustees later determine that one or more of the projects selected for implementation is/are not feasible due to unforeseen issues, the Trustees may pursue another project or projects from among the other projects evaluated in this Section. A project may be determined infeasible if, upon further investigation, the Trustees find that a project no longer satisfies the evaluation criteria used to select the preferred projects.

Table 5. Summary evaluation of the potential restoration projects.

PROJECTS	EVALUATION CRITERIA (See key below) H – High M – Medium *L* – Low											Overall Ranking
	Tier One		Tier Two									
	1	2	3	4	5	6	7	8	9	10	11	
Cullinan Ranch*	H	*M*	H	H	H	H	H	H	H	H	H	High
Breuner Marsh*	H	H	*M*	*M*	*M*	H	H	H	H	H	H	High
Pacheco Marsh	H	*L*	*M*	*M*	*M*	H	H	H	H	H	H	*Medium*
Baypoint Marsh	H	*L*	H	*L*	H	H	H	H	H	H	H	*Medium*
Eelgrass	*M*	*M*	*M*	*M*	*M*	H	H	H	H	H	H	*Medium*
Native Oyster	*M*	*M*	*M*	*M*	*M*	H	H	H	H	H	H	*Medium*
Creosote Piling Removal	H	H	*M*	*L*	H	*M*	H	*M*	*M*	H	H	*Medium*
Historical Richmond Marsh	H	H	*L*	*L*	*L*	*L*	*L*	H	*L*	*M*	*L*	*Low*
Wildcat Marsh	H	H	*M*	*L*	H	*L*	*L*	*L*	*M*	H	H	*Low*
Hoffman Marsh	H	*L*	*L*	*L*	*L*	H	*M*	H	*M*	*M*	*L*	*Low*

* Preferred Projects

Evaluation Criteria:

1. Relationship to injured resources and/or lost services
2. Proximity to Castro Cove and within the North Bay Subregion
3. Technical feasibility
4. Cost effectiveness
5. Time to provide full benefits
6. Duration of benefits
7. Compliance with applicable federal, State, and local laws and policies
8. Multiple resource and service benefits
9. Avoidance of adverse impacts
10. Public health and safety
11. Likelihood of success

4.6.1 Tidal Wetlands Restoration Projects

Several tidal wetlands restoration projects were identified in close proximity to Castro Cove and within the San Pablo Bay subregion. The Trustees carefully considered these projects because their expected resource benefits are most similar to the resources injured by the releases into Castro Cove. This type of restoration project best satisfies the Tier One threshold evaluation criteria. In addition, tidal wetlands creation and enhancement projects typically have a high likelihood of success and tend to be cost effective. Restoration of wetlands and water quality functions associated with wetlands can assist ongoing efforts to improve the health of the estuary. Also, tidal wetlands restoration projects generally are consistent with broad regional goals for restoring the ecological health of the San Francisco Bay estuary.

Tidal wetlands provide complex habitat supporting numerous fish and wildlife species. Tidal wetlands restoration will provide services benefiting a wide range of natural resources, including benthic invertebrate species that inhabit marshes and the bird and fish species that feed on them. By providing benthic invertebrates, critical nursery habitat for shrimp, fish and other aquatic species, and nesting and foraging habitat for shorebirds, waterfowl and other wildlife, restored marshes and mudflats will benefit many of the same species that were injured by the releases in Castro Cove.

The Trustees identified two projects from among the seven tidal wetlands restoration projects that best fit the evaluation criteria and that in combination provide sufficient restoration acreage to achieve the needed scale of restoration for this case. The Cullinan Ranch and Breuner Marsh restoration projects are identified in this draft DARP/EA as the Trustees' preferred restoration projects. The lead implementing agencies for these two projects are the USFWS National Wildlife Refuge Program and East Bay Regional Park District (EBRPD), respectively. The Trustees propose to contribute funds toward restoration of tidal wetlands habitat at each of these two sites to restore sufficient acreage to compensate for the estimated loss of natural resource services from contamination in Castro Cove.

4.6.1.1 Evaluation of Cullinan Ranch Restoration: Preferred Project

Project Description

The Cullinan Ranch site, located along the north side of San Pablo Bay approximately 10 miles north of Castro Cove, is one of the largest proposed restoration projects in the North Bay (see Figure 6). Cullinan Ranch is located in an area of the Napa River Delta that was historically defined by a network of meandering sloughs and extensive estuarine tidal marshes. The Cullinan Ranch restoration project would restore approximately 1,500 acres of diked baylands to their historical wetland state as mature tidal marsh. The project will convert pasture, grassland and seasonal wetlands into a mosaic of tidally influenced channels, mudflats, and salt marsh habitat. Cullinan Ranch is part of the San Pablo Bay National Wildlife Refuge (NWR) although some of the project would take place on lands managed by CDFG.

Restoration design includes a 10:1 sloped buttress levee, lowered levees along Dutchman Slough, and islands that will provide pickleweed habitat for endangered species within the first 2 years. The buttress levee will be constructed to enhance habitat and protect Highway 37 from tidal fluctuation. Breaching levees (constructed decades ago to dry out the marsh for farming) will restore tidal flow and create vital salt marsh habitat for endangered species, including the salt marsh harvest mouse and the California clapper rail, as well as providing foraging and roosting habitat for fish, migratory waterfowl, and waterbirds. It will take years of tidal exchange to return the land to mature intertidal marsh habitat found to the North in the Napa Sonoma Ponds. The tide will bring in sediment and gradually raise the bottom elevation of the site which has subsided over the decades as it had been diked and farmed. As the process begins, the site will provide shallow water habitat, functions, and services similar to

nearby ponds currently managed for bay fish and waterfowl. Gradually the marsh will evolve, the function will change and it will provide services for fish, clapper rails, salt marsh harvest mice and other tidal marsh species. This project is supported by several regional restoration and conservation groups and is considered a high priority project by the San Francisco Bay Joint Venture (http://www.sfbayjv.org/projects.html).

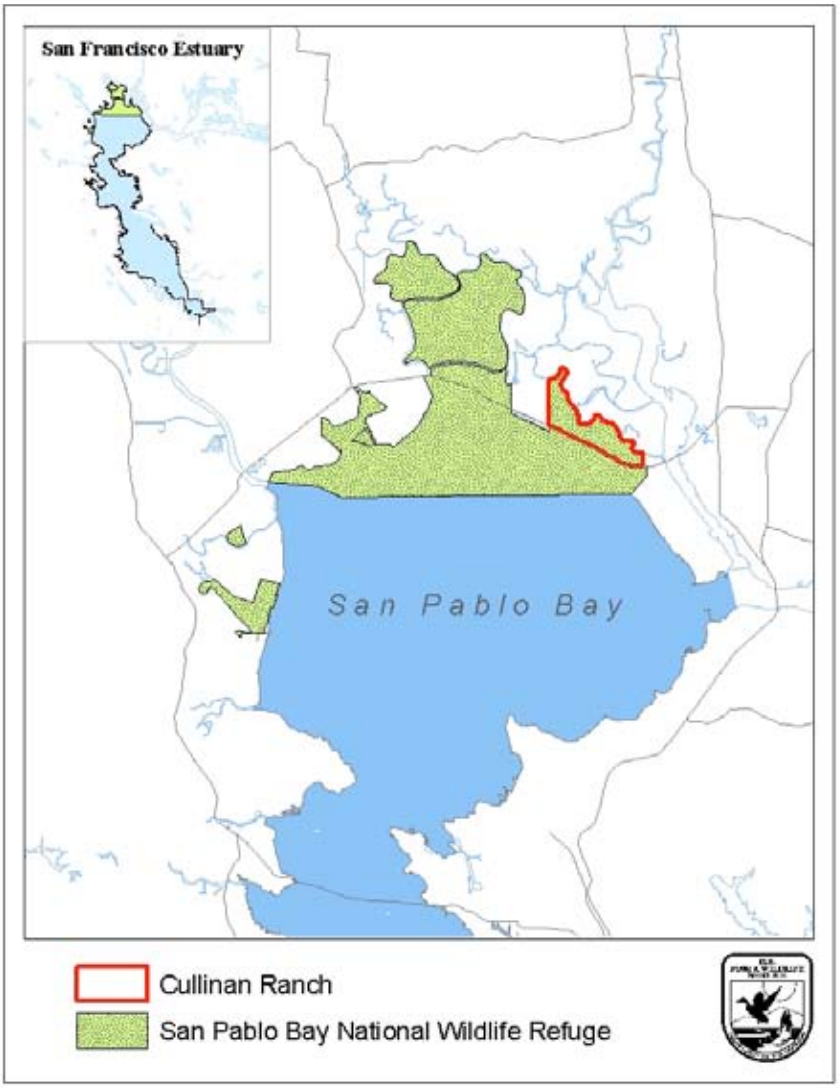

Figure 6. Location of Cullinan Ranch

Restoration Objectives

The project goal is to restore tidal influence to the Cullinan Ranch area to restore and create tidal marsh habitat for salt marsh-dependent species. The objective is to provide suitable habitat to support the endangered species in the larger San Francisco Bay ecosystem.

Scale

The project will restore approximately 1,500 acres to tidal wetlands. Since only 203 acres of restoration are needed to satisfy the Trustees' claim, the Trustees would fund only a portion of the project, in a proportionate amount to account for approximately 173 acres at Cullinan Ranch. The Trustees propose achieving the total needed restoration acreage by contributing to both the Breuner project described in section 4.6.1.2 (which is within the City of Richmond) and the Cullinan project. Based on information provided by EBRPD (Brad Olson, pers. com.), up to 30 acres of tidal wetlands restoration is planned for the Breuner site, leaving a balance of 173 restoration acres needed to achieve the 203 acres required for this case. Therefore, the Trustees propose allocating a portion of the tentative Chevron/Castro Cove settlement equivalent to the per acre cost of 173 acres of the Cullinan Ranch restoration project. The Trustees understand that this allocation would be sufficient to implement the first phase of the Cullinan Ranch restoration project.

Likelihood of Success

The probability of success for this wetland restoration project is high. The project site is a former salt marsh that has been converted to pasture through diking. Wetland restoration often can be achieved very rapidly in such situations. For example, wetland restoration following breaching of levees at CDFG's Pond 2A (Napa-Sonoma Marsh Complex) resulted in a salt marsh appearing structurally similar to natural ones within only five to six years. Across the Napa River from Pond 2A, reestablishment of wetlands at the Port of Oakland's American Canyon marsh, a former pasture that had subsided moderately (4 to 5 feet) since diking, also has progressed quickly since partial breaching of the levee only three years ago. While deposition of sediments to restore tidal marsh elevations at Cullinan may not proceed as rapidly as the above referenced projects, it is likely that natural sloughs and channels will evolve as the marsh plain develops because hydrologic sources and networks remain largely intact. By using some of the lessons learned from early restoration efforts within the Bay-Delta and elsewhere, the Trustees expect that the project will result in a wetland complex with functions and values similar to those achieved by other restoration projects and, perhaps more importantly, by other natural wetland systems.

Success Criteria and Monitoring

Success criteria will be developed to enable USFWS refuge managers and the Trustees to determine if the restoration actions at Cullinan Ranch are successful. To assist in developing success criteria, monitoring will be conducted prior to project implementation at the project site and selected "reference" wetlands. Monitoring of reference wetlands will enable the development of a range of values for various parameters of ecological structure and function, such as vegetation cover and species composition, nutrient levels in water and sediment, flood water retention, and wildlife use. In addition, implementing monitoring during the environmental compliance phases of the project will enable a comparison of pre-project and restored conditions. The exact post-construction monitoring schedule will be determined during design of the long-term monitoring program.

Approximate Project Cost
The Trustees estimated total costs for design, construction, contingencies, permitting, and monitoring between $10,000 and $12,000 per acre. This estimate includes all phases of environmental compliance (e.g., development of restoration alternatives, preparation of an Environmental Impact Statement (EIS), public scoping, Section 7 consultation, and preparation of other regulatory permits), construction, re-vegetation, and pre- and post-construction monitoring.

Environmental Consequences
The USFWS San Pablo Bay NWR prepared an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) under NEPA and CEQA to identify environmental consequences associated with restoration of the diked pasture land at Cullinan Ranch to tidal wetlands. The Draft Environmental Impact Statement/Environmental Impact Report, Cullinan Ranch Restoration Project, Solano and Napa Counties, California (Ducks Unlimited 2008) was released for public comment on May 2, 2008 with the public comment period closing June 17, 2008. Environmental baseline studies to identify existing vegetation communities, wetlands, and special status plant species, and surveys to document use by both common and special status wildlife species have already begun. Anticipated consequences of project implementation include a shift in the current vegetation communities (e.g., from predominantly pastureland with some freshwater marsh to salt, brackish, and freshwater marsh) resulting in changes in the types of common and special status species occurring at the site. While implementation will result in beneficial impacts for species associated with subtidal aquatic habitat and salt-marsh dependent species, adverse and unavoidable impacts are anticipated as seasonal wetlands and uplands are converted to tidal wetlands (Ducks Unlimited 2008). These impacts include habitat loss for burrowing mammals and wintering waterfowl and foraging habitat loss for certain raptors and special-status bat species. Mitigation measures, such as timing the construction period to avoid disturbance to breeding clapper rails and black rails, are planned so that there are no adverse effects to wildlife during construction.

Council on Environmental Quality (CEQ) regulations on NEPA recommend the avoidance of repetitive discussions when more than one environmental document addresses the same action (such as is the case for this DARP/EA and the Draft Cullinan Ranch Restoration EIS/EIR). One of the Trustee agencies for the Castro Cove case, USFWS, is also the lead agency for the Cullinan Ranch Restoration EIS/EIR. Therefore the federal Trustees are assessing project selection in this EA, and appropriately deferring the full analysis of the environmental consequences of implementing the Cullinan Ranch project to the USFWS herein incorporating by reference the analysis of environmental consequences contained in the Draft Cullinan Ranch Restoration EIS/EIR (Ducks Unlimited, 2008). Any Trustee funding of Cullinan Ranch would be conditioned upon the USFWS completing its EIS/EIR and issuing a Record of Decision that it will implement the project.

Evaluation
The tidal wetlands at Cullinan Ranch will provide important habitat for many species of fish and wildlife in the North Bay subregion, as well as maintaining the quality and productivity of estuarine and marine ecosystems as a whole. The intertidal and shallow subtidal habitats that were injured by the Chevron releases, serve as vital habitat for the same species of fish and wildlife that will benefit from the Cullinan Ranch project. There is a strong relationship between this restoration project and the injured resources.

This project ranks high in technical feasibility since planning and design have been performed and a Draft EIS/EIR has been released. This project will provide extensive resource and service benefits yet is also the most cost-effective project evaluated. Benefits to natural resources will occur relatively quickly based on the implementation schedule (2009). As Cullinan Ranch is part of the National Wildlife Refuge System (San Pablo Bay NWR), benefits are expected to accrue in perpetuity. Although temporary and permanent impacts to certain special status species may occur, overall, the project is expected to provide significant benefits to wildlife such as shorebirds, waterfowl, rails, salmon, steelhead, and flatfishes, as well as the ecosystem as a whole. The probability of success for this wetland restoration project is high.

The Trustees evaluated the project against the evaluation criteria developed to select restoration projects and concluded that this project is consistent with them. The Trustees determined that this type and scale of restoration will effectively provide appropriate compensation for intertidal and shallow subtidal injuries that occurred as a result of Chevron's releases to Castro Cove.

The Trustees consider funding a portion of this wetland restoration project, in combination with funding the tidal wetlands portion of the Breuner Marsh project, to best satisfy the evaluation criteria and provide appropriate compensation for fishery resources, wetlands, birds, and other biological resources injured as a result of the Chevron releases in Castro Cove. Therefore the Trustees propose contributing $1.9 million in tentative settlement funds to the Cullinan Ranch restoration project.

4.6.1.2 Evaluation of Breuner Marsh Restoration; Preferred Project

Project Description
The 218-acre Breuner property, in the City of Richmond, lies just south of Point Pinole Regional Shoreline in western Contra Costa County, California (Figure 7). Approximately 113 acres of the property is upland, seasonal wetland and tidal marsh, and 105 acres are open water, mudflats and other baylands.

The restoration design for this project is still at a conceptual stage but the conceptual plan calls for restoration and enhancement of up to 30 acres of tidal wetlands, 45 acres of seasonal wetland, 2 acres of riparian habitat along Rheem Creek, and 25 acres of coastal prairie/upland buffer in the 113-acre portion of the property. The restored tidal

Figure 7. Location of Breuner Property

wetlands at the Breuner site will provide spawning and nursery habitat for fish; foraging and roosting habitat for shorebirds, wading birds, waterfowl, passerines, and raptors; and another source of primary productivity (organic carbon and nutrients) to the Bay ecosystem. Improvement of the 30 acres is extremely valuable given that this is an important natural resource in a very industrialized portion of the Bay. No plans have been developed for the remaining 105-acres of the property, however, this area could be considered for enhancement of subtidal habitat (e.g., native oyster and eelgrass beds), mudflat, and shorebird roosting areas. Conceptual goals for public access include a public staging area, completing a key segment of the San Francisco Bay Trail, and providing improved public access to San Francisco Bay. This project is supported by several regional restoration and conservation groups and is considered a high priority project by the San Francisco Bay Joint Venture (http://www.sfbayjv.org/projects.html). The California Coastal Conservancy has identified the Breuner Marsh restoration project as a high priority for funding (Abe Doherty, pers com.).

The property was recently acquired by EBRPD through its eminent domain authority. EBRPD purchased the property on May 6, 2008.

Restoration Objectives
The preliminary goals for the property developed in the conceptual plan focus on wildlife habitat restoration and enhancement and development of public access, including completion of the San Francisco Bay Trail.

Scale
Of the 218 acres on the Breuner property, up to 30 acres are considered suitable for tidal wetlands restoration based on current planning by EBRPD (Brad Olson, pers. com.). In considering a request from the City of Richmond to expand the use of settlement funds for the Breuner site, the Trustees met with EBRPD, toured the Breuner site, and discussed the plans and restoration constraints for the site. EBRPD advised that increasing the amount of tidal wetlands restoration at the Breuner site is not feasible. The restoration of 30 acres of tidal marsh at Breuner will provide only a portion of the 203 acres needed to fully compensate for the injuries resulting from the contamination in Castro Cove, leaving 173 additional restoration acres needed to achieve the 203 acres required for this case. Therefore, the Trustees propose allocating a portion of the tentative Chevron/Castro Cove settlement to pay for the equivalent of 173 acres of the Cullinan Ranch restoration project. In addition, the Trustees propose reserving a portion of the tentative Chevron/Castro Cove settlement for the 30-acre tidal wetland portion of the Breuner Marsh restoration project.

Likelihood of Success
The likelihood of success for this wetland restoration project is expected to be high. EBRPD has completed numerous resource enhancement projects at other sites in the Bay area. Planning, compliance, construction, and monitoring involve proven conventional processes and methods. EBRPD has indicated that with a monetary allocation from the Chevron settlement it expects to be able to raise sufficient additional funding to implement this project.

Success Criteria and Monitoring
During detailed planning and compliance documentation, success criteria will be developed to enable EBRPD managers and the Trustees to determine if the restoration is successful. To assist in developing success criteria, monitoring will be conducted prior to project implementation at the project site and selected "reference" wetlands. Monitoring of reference wetlands will enable EBRPD to develop a range of values for various parameters of ecological structure and function, such as vegetation cover and species composition, nutrient levels in water and sediment, flood water retention, and wildlife use. In addition, implementing monitoring during the environmental compliance phases of the project will enable a comparison of pre-project and restored conditions. The exact post-construction monitoring schedule will be determined during design of the long-term monitoring program.

Approximate Project Cost
EBRPD has estimated, preliminarily, that the total cost for the 218-acre project, including upland projects, public access improvements, and other actions not within the scope of wetlands restoration is from $5 to $7 million. For marsh restoration

projects that do not yet have site-specific cost estimates, such as the Breuner property, the Trustees estimated costs based on an examination of the costs of similar projects previously planned and/or implemented in the San Francisco Bay area, and through contact with agencies or organizations that have conducted similar restoration work. A range of costs for restoring intertidal wetlands and mudflats was developed by compiling the implementation costs of several projects elsewhere in the San Francisco Bay Estuary for which detailed costs could be obtained, including Sonoma Wetlands, Bay Point Regional Shoreline, Sears Point Wetlands, Napa Sonoma Marsh, Bair Island, Hamilton Army Airfield, Cullinan Ranch, Cargill/Napa River, and Petaluma Marsh. The costs for restoring these sites roughly ranged from $11,000 to $76,000 per acre, with a median cost of approximately $25,000 per acre. Cost estimates for projects generally took into account planning and design costs, construction costs and contingencies, and long-term maintenance and monitoring costs.

Environmental Consequences

With the recent acquisition of the property, EBRPD will prepare a detailed plan for the restoration of the site and environmental compliance documentation under CEQA. Thus, this restoration project will not be ripe for detailed analysis of environmental consequences until after specific project implementation details are more fully developed. The Trustees will address supplemental NEPA requirements, if necessary, at the time that CEQA documentation is prepared by EBRPD. The Trustees provide below a level of environmental analysis appropriate for the current stage of planning for the Breuner Marsh project.

The actions to be undertaken to restore tidal wetlands at the Breuner site are likely to involve conventional construction methods and short term impacts similar to methods and impacts occurring in recent years at other similar wetlands restoration sites around San Pablo Bay and the greater San Francisco Bay estuary such as the projects listed in the *Approximate Project Cost* subsection above and the Cumulative Impacts section (4.7) below.

Biological Effects

The biological consequences of wetlands restoration such as those anticipated at the Breuner site are largely beneficial given the historical losses of such habitats within the affected area, their relative scarcity today, and their valuable ecological functions. Restoration of the Breuner site is expected to increase habitat value for tidal-marsh-dependent species in this portion of San Pablo Bay. It will provide habitat for many birds and other wildlife species including special status species such as the California clapper rail and salt marsh harvest mouse, as well as foraging and rearing habitat for many species of fish. Wetlands restoration, while beneficial for biological resources overall, requires careful planning, analysis, and consideration of the trade-offs between different and sometimes competing biological resources and uses. The project may convert habitat favored by some shorebirds and mammals to habitat favoring tidal marsh-dependent species. Mitigation measures, if needed, should be

identified during subsequent environmental analysis once project details are more fully developed.

Depending on their location and design, wetlands may provide benefits to water quality (USEPA 2001). Restoration of tidal exchange may also increase contributions of sediment from terrestrial watersheds into coastal areas. Wetlands restoration could also have several indirect physical effects, including hydrological consequences, the need to identify disposal requirements for excavated material, and potential impacts on roads and utilities. Mitigation measures, if needed, should be identified during subsequent environmental analysis once project details are more fully developed.

Evaluation

Restoring tidal wetlands at the Breuner site will provide important habitat for several species of fish and wildlife in the North Bay subregion, as well as maintaining the quality and productivity of estuarine and marine ecosystems as a whole. The project site is in close proximity to Castro Cove which is favorable, as there is a high likelihood that restoration will address resources similar to those that were injured.

Though EBRPD has not secured funding for the project, and detailed cost estimates for the tidal marsh component are not yet developed, EBRPD has indicated that monies provided by the Trustees would help it leverage other sources of funds to implement the project. The timing, implementation, and accrual of resource benefits are unknown at this time. However, the project will be owned and managed by a public agency, and its benefits are expected to accrue in perpetuity. The likelihood of success for this wetland restoration project is expected to be high.

The Trustees evaluated the project against the evaluation criteria developed to select restoration projects and concluded that this project is consistent with them. The Trustees determined that this type and scale of restoration will effectively provide appropriate compensation for mudflat and intertidal impacts that occurred as a result of Chevron's releases into Castro Cove.

The Trustees consider funding the tidal wetlands portion of the Breuner project, in combination with funding a portion of the Cullinan Ranch restoration project, to best satisfy the evaluation criteria and provide appropriate compensation for fishery resources, wetlands, birds and other biological resources injured as a result of the Chevron releases in Castro Cove. The Trustees propose to reserve $750,000 of the tentative settlement funds to apply toward the restoration of the 30 acres of tidal marsh.

4.6.1.3 Evaluation of Pacheco Marsh Restoration: Non-preferred Project

This project is located adjacent to Martinez in the Suisun subregion, approximately 14 miles East by Northeast from Castro Cove. The Muir Heritage Land Trust, Contra Costa County Flood Control District and the EBRPD acquired the 122-acre Pacheco

Marsh in 2002 to restore the property to its historic tidal wetland flow. The goal is to maximize wetland and wildlife habitat for a variety of plant and animal species, including the 12 special status species that would benefit from this restoration. They are looking for partners to fund design, permitting, and the implementation phases of this project. The estimated time to implementation is approximately 2 to 3 years and estimated time to reach full benefits is 5 years.

This project was not preferred for the following reasons: it is outside of the North Bay subregion and is among the more distant projects from the contaminated site and costs of restoration are relatively high compared to other available projects.

4.6.1.4 Evaluation of Bay Point Regional Shoreline Restoration: Non-preferred Project

This project is located along the southern shore of Suisun Bay near Pittsburg, approximately 25 miles East by Northeast from Castro Cove. Once part of a natural marsh, some 40 acres have been diked and partially filled. Exotic vegetation covers the site and the original grade has subsided. The project proponent, EBRPD, proposes to reestablish tidal flow and return the site to emergent tidal wetland habitat. The goal is to return approximately 33 acres to tidal action. The project costs are estimated at $1.5 million. This project is ready to implement with full benefits expected 3 to 5 years after implementation.

This project ranked lower than the preferred tidal wetlands projects for the following reasons: it is a greater distance from the contaminated site than other available projects; it is located in the Suisun subregion where salinity levels and associated plant and animal communities are not as comparable to the contaminated site as those sites in the North Bay subregion; and it has a relatively high project cost.

4.6.1.5 Evaluation of Wildcat Marsh: Non-preferred Project

Located adjacent to Castro Cove, on property owned by Chevron, this project involves removal and regrading of scattered imported fill material/levees in various portions of the marsh. This project initially ranked high because of its proximity to the injured site and strong relationship to the injured resources. The area that could benefit from restoration activities, however, is minimal (approximately 5 to 10 acres), and while some minor localized enhancements to address prior dredging operations (i.e., removing berms to reduce weedy upland patches of habitat) can be implemented, the marsh appears to be functioning at a relatively high level for natural resource services. These localized improvements probably would be expensive based on initial estimates relative to the limited benefits that would accrue. Also, Chevron could not provide assurance that the restored natural resources would remain protected in the long term.

This project was not preferred based on the lack of a project proponent, uncertainty over duration of benefits, and limited potential for habitat improvement.

4.6.1.6 Evaluation of Historical Castro Cove Wetlands: Non-preferred Project

The Trustees understand this concept encompasses restoring the large tidal marsh complex that historically spanned much of the area between the San Pablo Peninsula and Point Pinole prior to extensive filling and development over the past century. Most of this area has been filled and developed and is currently zoned for use by heavy industry, including the Chevron refinery and the rail yard. This area includes the oxidation pond where, under the CAP, Chevron has placed and capped the contaminated sediments dredged from Castro Cove.

This restoration concept would be highly constrained by current land use, ownership and on-site contamination. It does not, to the Trustees' knowledge, have a specific project proponent so the likelihood of success is low. It also is expected to be prohibitively expensive to displace the current businesses and structures located in the area, and remove and dispose of millions of tons of fill material. For these reasons, this project is not considered feasible for the restoration purposes of this case.

4.6.1.7 Evaluation of Hoffman Marsh: Non-preferred Project

The Trustees investigated the potential for tidal wetlands restoration at Hoffman Marsh, located in the Central Bay subregion. The Eastshore State Park General Plan includes exploration of small restoration opportunities in Hoffman Marsh, including removal of exotic plant species and re-vegetation with native plant species. There also are possible improvements to be made for shoreline protection along the south bank of the channel entering Hoffman Marsh. According to EBRPD, the northwest area of Hoffman Marsh is owned by several entities, complicating restoration opportunities. Currently, EBRPD and State Parks are not attempting to purchase these lands. While restoration opportunities such as removing contaminants, providing improved tidal circulation and removal of upland fill exist, until these properties are acquired by a public agency, EBRPD believes that there are limited opportunities for any restoration projects at Hoffman Marsh.

Based on current information, and lacking a specific restoration project to evaluate, restoration potential at Hoffman Marsh appears limited at this time by a number of constraints affecting feasibility. As there are other tidal restoration projects close to Castro Cove and within the North Bay subregion that better meet the Trustees' evaluation criteria, this project is not preferred.

4.6.2 Subtidal Restoration Projects

Subtidal restoration projects are those that enhance habitats that are found at the mean low water tide line or lower. The following subtidal projects were evaluated by the Trustees and were generally found to meet the evaluation criteria. The evaluated projects include: seeding subtidal areas with eelgrass, providing hard substrate on

which native oyster spat may settle, and removing contaminated pilings and pier structures. Eelgrass and native oyster communities in San Francisco Bay provide important habitat for benthic invertebrates, fish and birds. Creosote pilings have been shown to reduce the survival of bay fishes and some piling structures inhibit the growth of eelgrass due to shading. Restoring eelgrass and oysters and removing contaminated pilings within San Pablo Bay would benefit some of the same species that utilize the subtidal and intertidal habitats within Castro Cove. However, the relationship of the expected costs to the expected benefits from the restoration was not found to be as advantageous as for many of the tidal marsh projects.

4.6.2.1 Evaluation of Eelgrass Restoration: Non-preferred Project

Eelgrass is the predominant seagrass found in San Francisco Bay. It occurs in select locations just offshore and underwater and beds can vary in distribution, density, and height from year to year. Eelgrass beds create a valuable shallow-water habitat which provides shelter, feeding, and/or breeding habitat for many species of invertebrates, fishes, and waterfowl. Efforts to restore eelgrass beds in San Francisco Bay, administered by many community-based non-profit and scientific groups with financial support from NOAA, have been pilot efforts. New data suggest that these projects are feasible at a small scale, but they have not been attempted at a scale larger than ¼ acre in size. Eelgrass restoration costs have been estimated at approximately $65,000/acre. Eelgrass restoration could occur along the shoreline at Point Pinole, the Breuner property, WCCSL, and locations on the west side of Point San Pablo.

Although eelgrass restoration potentially satisfies the Trustees' primary criteria, technical feasibility and cost effectiveness are of significant concern. As there are tidal restoration projects close to Castro Cove and within the San Pablo subregion that better meet the Trustees' evaluation criteria and cost less than eelgrass restoration, this project is not preferred.

4.6.2.2 Evaluation of Native Oyster Restoration: Non-preferred Project

California oysters *(Ostreola conchaphila)* have declined throughout their range and have been reduced to a few scattered remnant populations in San Francisco Bay. The loss of oyster reef habitat impacted benthic and pelagic food webs. Without oyster reefs, eelgrass and other bottom habitats declined, replaced by broad expanses of shifting soft substrates. Feeding, sheltering, spawning, and nursery functions of these habitats were lost, impacting many benthic and pelagic species. Restoration of native oysters will provide biological, societal, and commercial benefits. NOAA funds projects which provide hard substrate on which native oyster spat may settle to restore native oysters in San Francisco Bay. These projects, administered by many community-based non-profit and scientific groups, have been pilot efforts. New data suggest that these projects are feasible at a small scale, but they have not been attempted at a scale larger than ¼ acre in size. Oyster restoration costs have been

estimated at approximately $314,000/acre. Offshore sites along the Richmond shoreline in which restoration of these habitats could occur include: the Breuner property, Point Pinole, WCCSL, and locations on the west side of Point San Pablo.

Although oyster projects potentially satisfy the Trustees' primary criteria, their technical feasibility and cost effectiveness are of significant concern. As there are tidal restoration projects close to Castro Cove and within the San Pablo subregion that better meet the Trustees' evaluation criteria and cost less than oyster restoration, this project is not preferred.

4.6.2.3 Evaluation of Creosote Pier and Piling Removal: Non-preferred Project

The Trustees have identified three locations (Richmond/San Rafael Bridge pile, Terminal 4, and the Red Rock Warehouse along the Point San Pablo Shoreline), totaling 7.8 acres, where creosote pilings might be removed; however, the Trustees have undertaken no formal survey and do not know the total number of individual pilings. While the removal of creosote pilings and associated structures would theoretically improve water and sediment quality resulting in improved biological conditions beneficial to fish and other aquatic life, the magnitude and spatial extent of expected improvement is unknown. Some information suggests that the pilings and dilapidated docks along the Point San Pablo shoreline also restrict the growth of eelgrass by shading.

The City of Richmond has received funding from the San Francisco Bay Conservation and Development Commission (BCDC) to remove pile supported structures at both the Terminal 4 site and the Red Rock Warehouse site. The Trustees were told by the Port of Richmond that a full survey of the area and bids for piling removal pursuant to the Scope of Work for this project are forthcoming.

The project is close to the affected area and is of similar habitat type to that injured by the Chevron releases into Castro Cove, thus satisfying the primary evaluation criteria. However, the expected resource benefits are low compared to high estimated project costs. This project is not preferred because there are tidal wetlands projects that better satisfy the evaluation criteria.

4.6.3 Riparian Restoration Projects

As stated in Section 4.6, the Trustees did not pursue detailed evaluation of the stream and riparian restoration projects because the benefits that they would provide do not restore the equivalent of the resources injured by the Chevron releases (criterion 1) and several potential in-kind tidal wetland and subtidal projects exist to restore the equivalent of the resources injured by the releases into Castro Cove.

4.6.4 Preferred Alternative

The Trustees identified two projects (see Sections 4.6.1.1 and 4.6.1.2) as the preferred alternative from among the seven tidal and three subtidal wetlands restoration projects evaluated in this Draft DARP/EA. The Cullinan Ranch and Breuner Marsh restoration projects best fit the evaluation criteria and in combination provide sufficient restoration acreage to achieve the needed scale of restoration for this case. This combination of restoration projects represents the Trustees' preferred alternative.

4.7 Cumulative Impacts

Cumulative impacts are impacts that result from an action along with other past, present, and reasonably foreseeable near-term future actions taken together. Significant cumulative impacts can result from a combination of actions that do not have significant impacts individually. Taken collectively, the effects of several actions may be additive, countervailing, or synergistic. Impacts are considered regardless of the agencies or parties involved. Thus, in considering cumulative impacts, this analysis is not limited to the actions of this case but also considers other projects in the region.

Overall, the preferred restoration projects toward which the Trustees propose contributing funding from the settlement of the Castro Cove NRDA will result in long-term net improvement in fish and wildlife habitat, restoration of ecological balance in areas where disturbances have led to adverse impacts on sensitive native species, and improvement in the natural resource services provided by fish and wildlife in the region. Cumulative impact analysis is nonetheless performed to evaluate whether there are specific components of the proposed actions that, when considered in combination with other closely related past, present, and future actions in the affected area, have potentially significant cumulative adverse effects.

The Trustees evaluated the restoration projects proposed in this DARP/EA in conjunction with other known past, proposed or foreseeable closely related projects that could potentially add to or interact with the proposed projects within the affected area to determine whether significant cumulative impacts may occur. Specifically, the proposed restoration projects were analyzed within the context of regional habitat restoration efforts, focusing on the North Bay (i.e. San Pablo Bay) subregion of the San Francisco Baylands Ecosystem Goals Project (Goals Project 1999). Castro Cove and the two wetlands restoration projects proposed for selection in this draft DARP/EA (Cullinan Ranch and Breuner Marsh) are all located within this North Bay subregion. Past, present, and reasonably foreseeable future actions considered in this cumulative impacts analysis are listed in Table 6.

Cumulatively, tidal wetlands creation and improvement projects in the area are expected to result in similar environmental effects (beneficial and adverse) as the preferred projects. A description of each of the other tidal restoration projects listed above is not provided in this DARP/EA; however, it can be generally stated that these

projects are intended to restore or enhance hydrology, water quality, and ecological functions in a manner similar to the two projects selected for funding in this DARP/EA.

Table 6. Completed and reasonably foreseeable tidal wetlands restoration projects in the San Pablo Bay region.

Bahia Lagoon	Nevada-Shaped Parcel, Richmond Shoreline at Wildcat Creek
Bel Marin Keys Unit V	Petaluma River Marsh
Breuner Marsh	Port Sonoma Marina Perimeter
Central Avenue Marsh	Sears Point
Cullinan Ranch	Skaggs Island
Gallinas Creek	Sonoma Baylands
Green Point/Toy Marsh	Tolay Creek
Hamilton Airfield	Tubbs Island
Mare Island Navy Mitigation Marsh	Vallejo Mitigation Sites
Mare Island Refuge	Wildcat Marsh
Napa River Salt Marsh Restoration Project	Petaluma River Marsh

Cumulative impact analysis has been performed for the Cullinan Ranch project and for several other past and planned regional tidal wetlands restoration projects listed above. These analyses of cumulative impacts, and associated regional habitat restoration plans and programs were compiled and reviewed by the Trustees during the preparation of this DARP/EA. CEQ regulations on NEPA recommend the avoidance of repetitive discussions when more than one environmental document addresses the same actions; thus in the interest of conciseness, cumulative impact analysis available in other referenced environmental documentation is simply summarized below.

The reintroduction of tidal influence to the selected project sites along with other tidal wetlands restoration projects in the region, would be expected to improve water quality in San Pablo Bay. In the long term, the overall water quality effects of the selected projects and other wetlands restoration projects is expected to be beneficial, since wetlands are generally acknowledged to provide favorable water quality improvement mechanisms such as filtration, settling, entrapment of sediment, and enhanced biological activity. Project construction could cause temporary water quality impacts; however, these impacts would be limited in scope and duration, would be mitigated by use of best management practices, and are unlikely to contribute to cumulative water quality impacts in San Pablo Bay.

One general concern about wetlands restoration projects being undertaken throughout the greater San Francisco Bay region is that many of the sites are subsided and proponents plan to import substantial amounts of dredged material or other fill material during implementation. Neither of the projects selected in this DARP/EA

anticipate use of off-site sediments. Restoration of large tracts to tidal influence also has the potential to alter tidal prisms and potentially affect the balance of sediment accretion and erosion, potentially resulting in a reduction of mudflat and shallow subtidal zones in certain areas. Long term monitoring of potential hydrological impacts of all tidal wetlands restoration sites has been and will continue to be required by regulatory authorities as a condition of implementation of these projects.
All of the past and proposed tidal wetlands restoration projects for this region are part of a long-term strategy to recreate a complex mosaic of wetlands habitats in the greater San Francisco Bay area. The selected projects, considered along with other wetlands restoration projects in the San Pablo Bay subregion, will result in cumulatively beneficial impacts to plants and wildlife, including special-status species, providing additional habitat to support recovery of these sensitive communities and resulting in greater habitat complexity, diversity, and productivity. These projects would cumulatively increase the availability and quality of fringe marsh, mudflat, and shallow water aquatic habitats throughout the region. A potentially significant adverse cumulative impact to which the selected projects may contribute is the conversion of current lands to tidal influence, resulting in a shift in biological communities from those that occupy the current land areas to tidal marsh-dependent bird, fish, mammal, and invertebrate species. Considerations for monitoring and potentially mitigating for potentially significant impacts to existing biological communities is addressed in the individual NEPA and CEQA documents for these projects.

More specifically, the potential conversion of certain open water and seasonal wetlands habitats to tidal marsh and mudflat habitats could potentially have adverse impacts on regional shorebird and waterfowl populations. Proposed tidal wetlands restoration projects in San Pablo Bay are expected to cumulatively alter the amount of open water and seasonal wetlands habitats used by shorebirds and waterfowl over the next several decades. This change could result in either an increase or decrease of open water habitats suitable for such species, depending on which restoration approaches are implemented. Neither the Cullinan Ranch nor the Breuner Marsh projects are anticipated to incrementally contribute to losses of such habitats. Regional habitat restoration plans, and site-specific environmental documentation for other tidal wetlands restoration projects in the region, address this potential impact.

Another potential cumulative impact from multiple tidal wetlands restoration projects is the potential for invasion of aggressive non-native plant species, such as certain cordgrass species (*Spartina alterniflora and Spartina densiflora*). The number of restoration projects planned in the region increases the availability of suitable habitat for colonization by these species, and in the past, several restoration projects along the shores of San Francisco and San Pablo bays have been degraded because of non-native cordgrass out-competing native California cordgrass. The ability to control the cumulative effects and spread of exotic species of cordgrass and other plants requires a regional effort and the willingness of resource agencies to fund estuary-wide control programs. Specific restoration projects require monitoring and control of exotic pest plant species within restored marsh areas, and coordination with the Invasive Spartina

Project (a regional program to control non-native *Spartina* in the San Francisco estuary).

For further detailed discussion of cumulative impacts, the reviewer is directed to environmental documentation on the following projects, provided in the references section: Cullinan Ranch Restoration Project EIS/EIR (Ducks Unlimited 2008); Hamilton Army Wetland Restoration Feasibility Study Final EIS/EIR (Jones and Stokes Associates 1998); Bahia Marsh Restoration Project EIR (California Department of Fish and Game 2006); South Bay Salt Ponds Final EIS/EIR (EDAW et al. 2007); and San Francisco Baylands Ecosystem Habitat Goals (Goals Project 1999).

4.7.1 Uncertainty: Impacts of Global Sea Level Rise on Coastal Wetland Habitats in San Francisco Bay

In addition to the above analysis of the environmental consequences and cumulative effects of the proposed actions, the Trustees describe here the potential that in the long term, climate change and sea level rise will have consequences on coastal resources in San Francisco Bay, including the projects analyzed herein. The Intergovernmental Panel on Climate Change estimates that the global average sea level will rise between 0.6 and 2 feet (0.18 to 0.59 meters) by the end of the 21st century (IPCC 2007).

Increased coastal flooding, loss of wetland habitats, an increase in the salinity of estuaries and freshwater aquifers, and changes in tidal ranges in rivers and bays, transport of sediments and nutrients, and patterns of contamination in coastal areas are amongst the main effects of sea level rise on coastal regions. These in turn will likely result in shifts in species compositions and an overall reduction in coastal wetlands productivity and function (Warren and Niering 1993; Titus 1991).

It is generally understood, however, that increases in temperature, sea-level rise, and changes in precipitation will degrade those benefits and services. It also is important to recognize the degree of uncertainties associated with projections of the consequences for wetland ecosystems resulting from climate change. For example, the ranges of change estimated for North America from pre-industrial levels are +/– 20 percent for precipitation, +/– 10 percent for evaporation and +/– 50 percent for runoff (Frederick 1997). There is further uncertainty regarding the increase in frequency and intensity of extreme events, such as storms, droughts, and floods. The ability of wetland ecosystems to adapt will be highly dependent on the rate and extent of these changes.

Coastal wetland flora and fauna generally respond to small, permanent changes in water levels. However, the degree to which they are able to adapt to these changes will depend to a great extent on the ability for species to ‘migrate’ to alternative areas. Rising sea levels will likely force wetland systems to migrate inland. However, this migration path could be obstructed by inland land uses or by the ability of these

systems and their components to migrate in sufficient time to persist. For example, many coastal and estuarine wetlands will be unable to migrate inland due to the presence of dikes, levees or specific human land uses close to the coastal area (Kusler et al. 1999).

The projected environmental benefits of planned tidal wetlands restoration projects may be affected by sea level rise in the 21st century. For instance, tidal wetlands restoration sites that are more constrained to their inland side by existing human development may be less able to adapt to rising sea level, reducing their intended long-term benefits. As the rate of relative sea level rise experienced at many locations along California's coast is somewhat consistent with the worldwide average rate of rise observed over the past century, it may be reasonable to assume that changes in worldwide average sea level through this century will also be experienced by California's coast (DWR 2006).

Ultimately the specific degree to which the intertidal and subtidal projects considered herein may be affected by sea level rise in the coming decades is uncertain and dependent upon different projections of climate change effects and how society chooses to adapt to these changes in the future.

5.0 APPLICABLE LAWS AND REGULATIONS

The major laws guiding the development of this Draft DARP/EA addressing restoration of the injured resources and services at the Castro Cove site are CERCLA and NEPA. These statutes and the regulations implementing them set forth a specific process of impact analysis and public review. In addition, implementation of selected restoration actions may trigger compliance with other applicable laws, regulations, and policies at the federal, state, and local levels. A brief description of the relevant and potentially relevant laws, regulations, and policies are set forth below.

5.1 Key Federal Statutes, Executive Orders, Regulations, and Policies

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (42 U.S.C. 9601 et seq.)

CERCLA, otherwise known as the Superfund law, provides the basic legal framework for the cleanup and restoration of the nation's hazardous substances sites. Under CERCLA, responsible parties are liable for damages, including reasonable assessment costs, for injuries to, or the loss of, natural resources. The term "natural resources" is broadly defined by CERCLA to mean "land, fish, wildlife, biota, air, water, ground water, 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, any foreign government, or any Indian tribe…." This statute provides that parties responsible for contamination of sites and the current owners or operators of contaminated sites are liable for the cost of cleanup and for damages to natural resources. Compensation is used to restore, replace, rehabilitate, or acquire the equivalent of natural resources and services.

CERCLA also required the promulgation of regulations for assessing natural resource damages resulting from the release of a hazardous substance and/or the discharge of oil for purposes of the CWA (33 U.S.C. 1321 (f)(4) & (5)). The Department of the Interior prepared the implementing regulations for natural resource damage assessment and restoration also referred to herein as the DOI Rule (43 C.F.R. Part 11). Federal and state agencies and Indian tribes may act as Trustees on behalf of the public to assess the injuries, to recover damages for those injuries, and to implement restoration. This Draft DARP/EA has been prepared jointly by the three trustee agencies with trust resources affected by contamination at the Castro Cove site: NOAA, USFWS, and CDFG. CERCLA and its implementing regulations for natural resource damage assessment and restoration provide that the designated Trustees shall develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent of the injured natural resources and lost services.

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

NEPA 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 purpose is 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." The law requires the federal government to consider the consequences of major federal actions on human and natural aspects of the environment to minimize, where possible, adverse impacts. Equally important, NEPA establishes a process of environmental review and public notification for federal planning and decision making.

Generally, when it is uncertain whether a proposed federal action will have significant effects, federal agencies will begin the NEPA planning process by preparing an environmental assessment (EA). They may seek public review and comment on the EA, and will consider any public comments in making a determination whether a proposed action is likely to have a significant impact on the environment or not If the effects of a project are considered significant, an EIS will be prepared. If they are determined not to be significant, a finding of no significant impact (FONSI) will be issued. In this case, the Trustees have chosen to prepare an EA, upon which they seek public comment, so as to be able to determine whether the proposed actions will result in significant environmental impacts. This analysis is performed to the level of detail possible given currently available information. Some of the restoration projects evaluated are at an early stage of planning, while other projects are currently undergoing or have already completed a separate NEPA analysis. Accordingly, as more site-specific information is developed, it may be necessary for the Trustees and/or the project implementer, as appropriate, to conduct further NEPA and/or CEQA analysis.

The Trustees have integrated CERCLA restoration planning with the NEPA analysis to achieve efficiencies and to meet the public involvement requirements of CERCLA and NEPA concurrently.

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

The CWA is the principal federal statute governing water quality. The goal of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The CWA regulates both the direct and indirect discharge of pollutants into the nation's waters. Section 301 of the CWA 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 permit.

Section 311 of the CWA regulates the discharge of oil and other hazardous substances into navigable waters and waters of the contiguous zone, as well as onto adjoining

shorelines, that may be harmful to the public or to natural resources. The CWA allows the federal government to remove the substance and assess the removal costs against the responsible party. Under the CWA, removal costs include those associated with the restoration or replacement of the natural resources damaged or destroyed as a result of a discharge of oil or a hazardous substance. Section 301 (c) of CERCLA required the promulgation of regulations for assessing natural resource damages resulting from the release of hazardous materials as well as the discharge of oil for purposes of the CWA (33 U.S.C. 1321 (f)(4) & (5)). The DOI prepared the implementing regulations for natural resource damage assessment and restoration under CERCLA and the CWA also referred to herein as the DOI Rule (43 C.F.R. Part 11). This Draft DARP/EA has been prepared jointly by the three trustee agencies with trust resources affected by contamination at the Castro Cove site: NOAA, USFWS, and CDFG. The DOI Rule provides that the designated Trustees shall develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent of the injured natural resources and lost services.

Section 404 of the act authorizes the U.S. Army Corps of Engineers to issue permits, after notice and opportunity for public hearings, for the disposal of dredged and fill material into navigable waters. Generally, projects that discharge dredged or fill material into waters including wetlands require Section 404 permits. Section 401 of the CWA provides that projects that involve discharge or fill to wetlands or navigable waters must obtain certification of compliance with state water quality standards. The Trustees anticipate that the tidal wetlands restoration projects at Cullinan Ranch and the Breuner property will require permits under the CWA; the implementing agency for each project will apply for these permits as appropriate after sufficient site-specific information is developed.

The Clean Air Act (42 U.S.C. 7401, et seq.)

The Clean Air Act (CAA) is the principal federal statute governing air quality. The primary goal of the CAA is to protect and enhance the quality of the nation's air resources so as to promote the public health and welfare and the productive capacity of its population. The CAA regulates both the direct and indirect discharge of airborne pollutants. Section 7471 of the CAA states that applicable implementation plans shall contain emission limitations and such other measures as may be necessary, as determined under regulations promulgated under this part, to prevent significant deterioration of air quality.

The Trustees anticipate that the restoration projects at Cullinan Ranch and the Breuner property may require discussion of general conformity requirements; the implementing agency for each project will address these requirements after sufficient site-specific information is developed.

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

The goal of the Coastal Zone Management Act (CZMA) is to encourage states to preserve, protect, develop, and, where possible, restore and enhance valuable natural

coastal resources. Participation by states is voluntary. The State of California has enacted the federally approved California Coastal Act.

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 outline the consistency procedures.

The San Francisco Bay Conservation and Development Commission (BCDC) is the federally-designated state coastal management agency for the San Francisco Bay segment of the California coastal zone. This designation empowers the BCDC to use the authority of the federal Coastal Zone Management Act to ensure that federal projects and activities are consistent with the policies of the Bay Plan and state law.

The Trustees believe that the selected projects can be implemented in a manner that will either have no effect on coastal resources or uses or will be consistent to the maximum extent practicable with the McAteer-Petris Act (California Government Code Sections 66600 to 66694) and the San Francisco Bay Plan. The Trustees anticipate that the BCDC will concur. The Trustees and/or the project implementers, as appropriate, will seek concurrence for these projects; however, for the tidal marsh restoration project at the Breuner property, further site-specific development will be necessary before it is appropriate to seek BCDC's 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 on which they depend. The ESA directs all federal agencies to use their authorities to further these purposes. Pursuant to Section 7 of the ESA, each federal agency shall, in consultation with the Secretaries of NOAA and/or USFWS, ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat.

Under the ESA, NOAA's National Marine Fisheries Service (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 NMFS to provide a list of threatened, endangered, proposed, and candidate species and designated critical habitats that may be present in the project area. If no species or critical habitats are present, the federal action agency has no further ESA obligation under Section 7. If a listed species is present and the federal action agency determines that the project may affect a listed species, consultation is required. The first phase of consultation is informal. For major construction activities, a biological assessment is required to assist in the determination of whether the proposed action is likely to

adversely affect listed species and critical habitats. For actions that are not major construction activities, the federal action agency must provide the USFWS and/or NMFS with an account of the basis for evaluating the likely effects of the action.

If the federal action agency concludes that the project will not adversely affect listed species or critical habitats, the agency submits a "not likely to adversely affect" determination to the USFWS and/or NMFS for its concurrence. If the USFWS and/or the NMFS concurs with the federal action agency that the project is not likely to adversely affect any listed species, then the consultation (informal to this point) is concluded and the decision is put in writing.

If the federal action agency determines that a project may adversely affect a listed species or a designated critical habitat, formal consultation is required. 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 the NMFS 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 threatened and endangered species occur in the project areas for this Restoration Plan, including steelhead, the salt marsh harvest mouse, and the California clapper rail. For each project that is selected in the final Restoration Plan, the Trustees and/or the project implementer, as appropriate, will evaluate the potential effects of the project on listed species and critical habitat. Based on this analysis, the Trustees and/or the project implementer will perform the appropriate level of consultation with the USFWS and/or the NMFS pursuant to Section 7 of the ESA.

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 (Public Law 104-297) 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 an 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 anticipate that either proposed project has the potential to affect an EFH. If, upon development of further site-specific information, it is determined that either project could affect an EFH, the Trustees and/or the project implementer, as appropriate, will consult with appropriate NOAA officials.

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

The federal Fish and Wildlife Coordination Act requires that federal agencies consult with the USFWS, the NOAA Fisheries Service, 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 CWA, NEPA, or other federal permit, license, or review requirements.

The Trustees and/or the project implementers will consult with the appropriate agencies as they pursue any required permitting for specific actions that may trigger such consultation.

Marine Mammal Protection Act (16 U.S.C. 3371, et seq.)

Under the Marine Mammal Protection Act (MMPA), the Secretary of Commerce is responsible for the conservation and management of pinnipeds (other than walruses) and cetaceans. The Secretary of the Interior is responsible for walruses, sea otters, polar bears, manatees, and dugongs. The Secretary of Commerce delegated MMPA authority to the NOAA Fisheries Service. Title II of the act established an independent Marine Mammal Commission and its Committee of Scientific Advisors to oversee and recommend actions necessary to meet the intents and provisions of the act. The act provides that the Secretary shall allow the incidental, but not intentional, taking, by U.S. citizens engaged in activities other than commercial fishing of small numbers of depleted as well as non-depleted marine mammals if, after notice and opportunity for public comment, the secretary finds that the total of such taking will have a negligible impact on the affected species or stock, and prescribes regulations setting forth permissible methods of taking, and requirements for mitigating, monitoring and reporting such taking.

The Trustees have determined that the Cullinan Ranch project does not have the potential to affect marine mammals. Although further project development is necessary, the Trustees do not anticipate that the tidal marsh restoration project at the Breuner property will have the potential to affect marine mammals. However, if necessary, the Trustees and/or the project implementer, as appropriate, will consult with appropriate NOAA or USFWS officials after sufficient site-specific information is developed.

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 (amended several times) to provide for avian protection by the federal government. Among its other provisions, it broadly 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 game birds, including waterfowl and certain shore birds, is annually regulated through a process in which the USFWS sets "framework regulations" based on the best current population data available, and states pass regulations that conform to those federal regulations. All other prohibited actions are only allowed under specific permits issued by the USFWS. Criminal violations of this act are enforced by USFWS, and it is also the primary statute under which USFWS and the DOI have responsibility to manage all migratory birds wherever they occur, including marine birds.

If selected, projects discussed in this Draft DARP/EA will be conducted in full compliance with the MBTA.

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

The federal Rivers and Harbors Act regulates 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 CWA 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 mechanism.

Executive Order 11988: Construction in Flood Plains

This 1977 executive order (EO) directs federal agencies to avoid, to the extent possible, the long-and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of development in floodplains wherever there is a practicable alternative. Each agency is responsible for evaluating the potential effects of any action it may take in a floodplain. Before taking an action, the federal agency should determine whether the proposed action would occur in a floodplain. For any major federal action significantly affecting the quality of the human environment, the evaluation would be included in the agency's NEPA compliance document(s). The agency should consider alternatives to avoid adverse effects and incompatible development in floodplains. If the only practicable alternative requires siting in a floodplain, 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 floodplain.

All of the projects evaluated in this Draft DARP/EA are either not in a floodplain (i.e. subtidal projects) or are of a type compatible with the functions of a floodplain (i.e. wetlands restoration).

Executive Order 13112: Invasive Species

EO 13112 applies to all federal agencies whose actions may affect the status of invasive species and requires agencies to identify such actions and to the extent

practicable and permitted by law (1) take actions specified in the order to address the problem consistent with their authorities and budgetary resources; and (2) 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 will require those implementing any selected projects to comply with the requirements of this Executive Order.

Executive Order 13186: Protection of Migratory Birds

EO 13186, titled the Responsibilities of Federal Agencies to Protect Migratory Birds, requires federal agencies to avoid or minimize the effects of their actions on migratory birds, and, in some cases, to evaluate the effects of actions and plans on migratory birds during environmental analyses. The EO further directs federal agencies taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement, within two years, a Memorandum of Understanding with the USFWS that shall promote the conservation of migratory bird populations.

Neither of the proposed projects is expected to have negative effects on migratory bird populations.

Executive Order 12898: Environmental Justice

The 1994 Executive Order 12898 requires 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 EO 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 CEQ has oversight of the federal government's compliance with EO 12898 and NEPA.

All potential actions considered in this Draft DARP/EA are expected to have positive environmental impacts and not to impose any adverse impacts on any community.

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. These guidelines are intended to ensure and maximize the quality of the objectivity, utility, and integrity of such information. This Draft DARP/EA is an information product covered by the information quality guidelines established by NOAA and the DOI for this purpose. The quality of the information contained herein is consistent with these guidelines, as applicable.

5.2 Key State of California 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 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, and that has the potential to impact the environment. Once the 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.

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 EIR. The test for determining whether an 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 DARP/EA and subsequent FONSI, if issued, may be relied upon or adopted by the state trustee agencies or the lead agency for the project(s) towards compliance with CEQA where appropriate. To this end, the State Trustee, CDFG has coordinated with the federal Trustees to ensure the EA and FONSI (if issued) comply with CEQA guidelines (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 selected projects. The lead agency for such projects will be required to carry out any additional CEQA compliance, as appropriate.

McAteer-Petris (California Government Code Sections 66690, et seq.)

The McAteer-Petris Act established the BCDC as a state agency with authority to regulate development in and around San Francisco Bay. The Act describes the broad policies the BCDC must use to decide whether to issue permits for activities in and along the shoreline of San Francisco Bay. The Act was first adopted in 1965 to establish the BCDC as a temporary State agency. The BCDC was charged with preparing a plan for the long-term use of the Bay and regulating development in and around the Bay. The San Francisco Bay Plan (Bay Plan) was completed in January 1969. In August 1969, the McAteer-Petris Act was amended to make BCDC a permanent agency and to incorporate the policies of the Bay Plan into State law.

The Trustees do not anticipate that any of the preferred restoration projects in this Draft DARP/EA will adversely affect coastal resources in the San Francisco Bay segment of the California Coastal Zone. However, the implementing entity for each project will be required to apply for any necessary permits and approvals, including any required San Francisco Bay permit.

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

Pursuant to the California Endangered Species Act (CESA) (California Fish and Game Code Sections 2050 et seq.), 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.

Several threatened and endangered species occur in the project area for this Restoration Plan, including the salt marsh harvest mouse and the California clapper rail. For each project that is selected in the final Restoration Plan, the Trustees and/or the project implementer, as appropriate, will evaluate the potential effects of the project on listed species and critical habitats. While the Trustees do not believe the proposed restoration projects would result in the take of any state-listed species, the implementing entity will be required to consult with the CDFG as may be appropriate pursuant to the requirements of the CESA.

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

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

5.3 Other Potentially Applicable Statutes, Regulations, and Authorities

Additional statutes may be applicable to NRDA planning activities. The statutes listed below, or their implementing regulations, may require permits from federal or state permitting authorities.

- 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)
- 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 (Porter-Cologne)

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7.0 REFERENCES

Battelle and ENTRIX, Inc. 2002. Appendix D.1: Draft Skeet Range Probability Model Parameter Proposal *in* Draft Remedial Investigation Report: Skeet Range (Alameda Point, formerly Alameda Naval Air Station).

Beckvar, N, TM Dillon, and LB Read. 2005. Approaches for linking whole body fish tissue residues of mercury or DDT to biological effects thresholds. Environmental Toxicology and Chemistry 24:2094–2105.

Birge, WJ, JA Black, AG Westerman, and JE Hudson. 1979. The effects of mercury on reproduction of fish and amphibians. Pp 629-655. *In* JO Nriagu (ed.) Biogeochemistry of mercury in the environment. Elsevier/North-Holland Biomedical Press, New York.

California Department of Fish and Game, 2006. Bahia Marsh Restoration Project EIR. www.sfbayjv.org/bahiaFEIR.html

DTSC, HERD. 2000. EcoNOTE4: Use of Navy/U.S. Environmental Protection Agency (USEPA) Region 9 Biological Technical Assistance Group (BTAG) Toxicity Reference Values (TRVs) for Ecological Risk Assessment. http://www.dtsc.ca.gov/AssessingRisk/eco.cfm

Ducks Unlimited. 2008. Draft Environmental Impact Statement/Environmental Impact Report, Cullinan Ranch Restoration Project, Solano and Napa Counties, California. Prepared for U.S. Fish and Wildlife Service and California Department of Fish and Game.

DWR. 2006. Progress on Incorporating Climate Change into Management of California's Water Resources. Technical Memorandum Report. California Department of Water Resources. http://baydeltaoffice.water.ca.gov/climatechange/reports.cfm

EDAW, Philip Williams and Associates, Ltd., HT Harvey and Associates, Brown and Caldwell, and Geomatrix. 2007. South Bay Salt Ponds Restoration Project Final Environmental Impact Statement/Report. Submitted to U.S.Fish and Wildlife Service and California Department of Fish and Game. www.southbayrestoration.org/EIR/downloads.html

ENTRIX. 2006. Additional models for the estimation of benthic mortality in Castro Cove, Memorandum to Mike Amman of Chevron, March 9.

ENTRIX. 2006. Estimation of historical sediment chemical concentration in Castro Cove, Memorandum to Mike Amman of Chevron, February 23.

ENTRIX. 2006. Models of injury assessment for the estimation of benthic service losses in Castro Cove, Memorandum to Mike Amman of Chevron, February 23.

ENTRIX. 2006. Preliminary estimation of discounted service-acre-year (DSAYs) losses in Castro Cove, Memorandum to Mike Amman of Chevron, April 13.

ENTRIX. 2006. Preliminary hazard quotient risk estimation to wildlife for Castro Cove, Memorandum to Mike Amman of Chevron, March 20.

ENTRIX. 2006. Regional background chemical concentrations for Castro Cove, Memorandum to Mike Amman of Chevron, February 23.

ENTRIX. 2006. Risk and Injury Assessment to Fish in Castro Cove, Memorandum to Mike Amman of Chevron, May 22.

ENTRIX. 2006. Risk assessment approach for HEA, Memorandum to Mike Amman of Chevron, February 22.

ENTRIX. 2006. Risk to shorebirds and waterfowl from lead pellet ingestion at Skeet Hill in Castro Cove, Memorandum to Mike Amman of Chevron, June 21.

ENTRIX. 2006. Sediment concentrations of mercury in regional (SFEI) and Castro Cove (Tier 1) data – A basis of establishing reference or background conditions, Memorandum to Mike Amman of Chevron, January 18.

ENTRIX. 2006. Spatial extent of potential service losses in Castro Cove, Memorandum to Mike Amman of Chevron, February 23.

Field, LJ, DD MacDonald, SB Norton, CG Ingersoll, CG Severn, D Smorong, and R Lindskoog. 2002. Predicting amphipod toxicity from sediment chemistry using logistic regression models. Environmental Toxicology and Chemistry 21:1993–2005.

Frederick, K. 1997. Water resources and climate change. Climate Issues Brief no. 3. Resources for the Future, Washington D.C., 14 p.

Goals Project. 1999. Baylands Ecosystem Habitat Goals. A report of habitat recommendations prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. U.S. Environmental Protection Agency, San Francisco, Calif./S.F. Bay Regional Water Quality Control Board, Oakland, California. www.sfei.org/sfbaygoals/

IPCC. 2007. Climate Change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, ML Parry, OF Canziani, JP Palutikof, PJ van der Linden and CE Hanson, Eds., Cambridge University Press, Cambridge, UK, 976 pp.

Jones and Stokes Associates. 1998. Hamilton Army Wetland Restoration Feasibility Study Final EIS/EIR. www.spn.usace.army.mil/hamilton/

Kusler, J, M Brinson, W Niering, J Patterson, V Burkett, and D Willard. 1999. Wetlands and Climate Change: Scientific Knowledge and Management Options. Institute for Wetland Science and Public Policy, Association of Wetland Managers. Berne, NY, USA.

McKim, JM, GF Olson, GW Holcombe, and EP Hunt. 1976. Long-term effects of methylmercuric chloride on three generations of brook trout (*Salvelinus fontinalis*): toxicity, accumulation, distribution, and elimination. Journal Fisheries Research Board Canada 33:2726–2739.

NOAA. 2002. Hylebos Waterway Natural Resource Damage Settlement Proposal Report. A habitat restoration-based approach for resolving natural resource damage claims relating to the Hylebos Waterway of the Commencement Bay nearshore/tideflats superfund site combined with a proposal for allocating liability for settlement purposes. March 14.

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

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

URS. 2002a. Additional sediment characterization and risk evaluation: Skeet Hill. Prepared for Chevron Products Company, Richmond, California. March 26.

URS. 2002b. Tier II Sediment Characterization and Ecological Risk Assessment Castro Cove. Prepared for Chevron Products Company, Richmond, California. June 7, 2002.

URS. 1999. Draft Sediment Characterization and Tier I Ecological Risk Assessment for Castro Cove Tier I Report. Prepared for Chevron Products Company, Richmond, California. May 17, 1999.

U.S. Environmental Protection Agency (USEPA). 2001. Wetlands functions and values. Web page. Available at http://www.epa.gov/owow/wetlands/functions.html Functions and Values of Wetlands. USEPA Fact Sheet 843-F-01-002c.

Snarski, VM and GF Olson. 1982. Chronic toxicity and bioaccumulation of mercuric chloride in the fathead minnow (*Pimephales promelas*). Aquatic Toxicology 2:143–156.

Tetra Tech EM Inc. 2000. Final Offshore Areas Ecological Risk Assessment, Mare Island, Vallejo, California, Volume 2. Prepared for U.S. Department of the Navy. Contract No. N62474-94-D-7609 Task Order No. 082.

Titus, JG. 1991. Greenhouse effect and coastal wetland policy: How Americans could abandon an area the size of Massachusetts at minimum cost. Environmental Management 15: 39-58.

Warren, RS and NA Niering. 1993. Vegetation change on a Northeast tidal marsh: Interaction of sea level rise and marsh accretion. Ecology 74: 96–103.

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9.0 APPENDICES

APPENDIX A: Injury Quantification