National Park Service | Marin County

Wetland and Creek Restoration at Big Lagoon, Muir Beach, Marin County

Final Environmental Impact Statement/ Environmental Impact Report

SCH# 2004042143

December 2007

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Final
Environmental Impact Statement/ Environmental Impact Report

Wetland and Creek Restoration at Big Lagoon, Muir Beach

SCH #2004042143

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December 2007

Jones & Stokes. 2007. *Wetland and Creek Restoration at Big Lagoon, Muir Beach Final Environmental Impact Statement/Environmental Impact Report*. (SCH# 2004042143) December. (J&S 05052.05.) Oakland, CA.

Final Environmental Impact Statement/Environmental Impact Report
Wetland and Creek Restoration at Big Lagoon, Muir Beach

GOLDEN GATE NATIONAL RECREATION AREA
Marin County, California
Lead Agencies: National Park Service and County of Marin

ABSTRACT

The *Wetland and Creek Restoration at Big Lagoon, Muir Beach Final Environmental Impact Statement/Environmental Impact Report* (Final EIS/EIR) presents and evaluates alternatives to restore a functional, self-sustaining ecosystem and provide for public access that is compatible with restoration. The 38-acre project site is located entirely within the boundaries of the Golden Gate National Recreation Area but includes some properties owned by the San Francisco Zen Center and Marin County.

This Final EIS/EIR analyzes three **Restoration Alternatives** with varying degrees of wetland or open water enhancement. All Restoration Alternatives include realigning the Redwood Creek channel, enhancing the backbeach tidal lagoon, removing invasive plant species, and removing constructed features such as the levee road. The Restoration Alternatives are designed to enhance natural creek and wetland function, provide sustainable habitat for federally listed salmonids and the California red-legged frog, and reduce flooding on Pacific Way.

Six **Public Access Alternatives** analyzed in this Final EIS/EIR represent varying capacities, configurations, and locations for a visitor parking lot at Muir Beach. All Public Access Alternatives are designed to reduce impacts on Redwood Creek, improve flooding conditions, and provide vehicular and new trail access from Highway 1 to Muir Beach.

This Final EIS/EIR analyzed four **Bridge Alternatives** to replace the existing Pacific Way Bridge. Under all alternatives, the new bridge would be higher and longer than the existing bridge to reduce flooding and provide vehicular access. The Bridge Alternatives vary in length, the height of the roadway approach, and their long-term accommodation of potential channel migration.

Additionally, five **Fill Disposal Alternatives** were analyzed in the Final EIS/EIR to address the issue of reuse or disposal of fill generated by construction activities associated with the Restoration and Public Access Alternatives.

Comments: Written comments must be postmarked or transmitted no later than 45 days from the date of EPA's notice of filing published in the Federal Register. Review copies will be available at lead agencies' offices and local libraries. The complete document will be posted on the GGNRA's web site (http://www.nps.gov/goga) and on NPS's Planning, Environment and Public Comment (PEPC) web site (http://parkplanning.nps.gov/goga). Written comments will be accepted online at http://parkplanning.nps.gov/goga (click the project title and follow instructions) or by sending a letter addressed as follows: Superintendent, Golden Gate National Recreation Area, Fort Mason, Building 201, San Francisco, CA 94123 (Attn: Restoration at Big Lagoon). A public meeting will be scheduled during the public review period (see project website noted above for details).

A Notice of Availability of the Final EIS/EIR has been published in the Federal Register. Under CEQA guidelines the document is being made available for a 45-day public review and comment period. No sooner than 45 days from the date that the U.S. Environmental Protection Agency's notice of filing is published in the Federal Register, the NPS will prepare a Record of Decision (ROD). Following confirmation of available funding, the Final EIS/EIR will be certified by Marin County and the County will issue a Notice of Determination (NOD) pursuant to CEQA. This document will be distributed to all recipients of the Draft EIS/EIR. Questions regarding this project may be directed to Steve Ortega (415) 561-4841, or emailed to: goga_planning@nps.gov.

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Exhibit 2: Final Environmental Impact Statement

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Executive Summary

Exhibit 2: Final Environmental Impact Statement

Executive Summary

Introduction

This Final Environmental Impact Statement/Environmental Impact Report (Final EIS/EIR) evaluates alternative approaches for the Wetland and Creek Restoration at Big Lagoon, Muir Beach. The project area is entirely within the boundary of the Golden Gate National Recreation Area (GGNRA) of the National Park Service (NPS), but only half of the project site is owned by NPS. Other landowners are the San Francisco Zen Center (SFZC), which operates Green Gulch Farm, and the County of Marin (County).

NPS and the County of Marin have prepared this Final EIS/EIR in accordance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The Final EIS/EIR identifies and analyzes potential impacts associated with multiple alternatives for ecological restoration, public access improvements, bridge replacement, and fill disposal locations. The alternatives are based on project goals, park values, effective restoration strategies, NPS and County policy, and applicable law.

This document has gone through an extensive public review process, resulting in a series of revisions prior to release of this Final EIS/EIR. A Notice of Intent and Notice of Preparation were prepared for the project, and comments were received from many agencies, organizations, and members of the public. A series of meetings were held during the scoping process including public meetings, informal stakeholder and interagency consultation, and public scoping meetings. As part of the 75-day public review period, the Draft EIS/EIR was then circulated to local, state, and federal agencies and to interested organizations and individuals to allow them to review and comment on the report. Comments received on the Draft EIS/EIR, and responses to those comments, have been compiled into Chapter 6 of this Final EIS/EIR document. In response to public comments, changes were made to the project alternatives, as discussed in the Master Responses section of the Final EIS/EIR in Chapter 6, Comments and Responses. Thus, the text presented in the Draft EIS/EIR has been modified. Revisions are shown as follows: text that has been deleted is shown in ~~strikeout~~, and text that has been inserted is <u>underlined</u>.

A Notice of Availability of the Final EIS/EIR has been published in the Federal Register, sent to the Governor's Office of Planning and Research, CEQA Clearinghouse, and posted at the Office of the County Clerk. Under CEQA guidelines the document is being made available for a 45-day public review and

comment period. This period will begin on the date of the Environmental Protection Agency's notice of filing published in the Federal Register. At the completion of this process, a Record of Decision (ROD) will be issued by NPS that will specify all elements of the selected plan which will be implemented. Following confirmation of available funding, the Final EIS/EIR will be certified by Marin County and the County will make a determination regarding improvements to Pacific Way and the Pacific Way Bridge and issue a Notice of Determination (NOD) pursuant to CEQA.

This executive summary provides a brief overview of the project purpose and need; project goals; alternatives; environmental consequences of the alternatives; plans and plan consistency; areas of controversy; issues to be addressed or resolved, and major conclusions.

Project Overview

Project Area

The project area is the mouth of the Redwood Creek Watershed, which is recognized for its local and regional importance. The watershed is part of one of 25 global biodiversity "hot spots" recognized by The Nature Conservancy and targeted by the global conservation community as key to preserving the world's ecosystems (Stein et al. 2000). It is within the Golden Gate Biosphere Reserve, one of 411 reserves designated by the United Nations Educational, Scientific, and Cultural Organization's (UNESCO) Man and the Biosphere Program to provide a global network representing the world's major ecosystem types.

The project area includes 38 coastal acres at Muir Beach and encompasses the entire wetland, creek, and riparian area extending from just downstream of Highway 1 (Hwy 1) to the beach, along with a small intermittent tidal lagoon at the beach (see Figure ES-1). The project area is referred to as "Big Lagoon" because an extensive open water body at the site was first mapped in 1853 and labeled as a "big lagoon" on the map. Although the large open water body no longer occurs, the site retains the name "Big Lagoon."

Project Background

Restoration needs and opportunities at the site have long been recognized because a history of prior land uses have highly altered the creek, wetland, riparian, and dune systems at the site. Restoration planning at the Big Lagoon site was first initiated in the early 1990s by the California Department of Transportation (Caltrans). Caltrans identified the project as possible mitigation for damage caused by their disposal of fill material in the intertidal and subtidal zone during the repair of the Lone Tree Slide on Hwy 1, near Stinson Beach. Caltrans worked with NPS and other agencies to develop preliminary restoration design alternatives, and numerous public meetings were held at that time. A

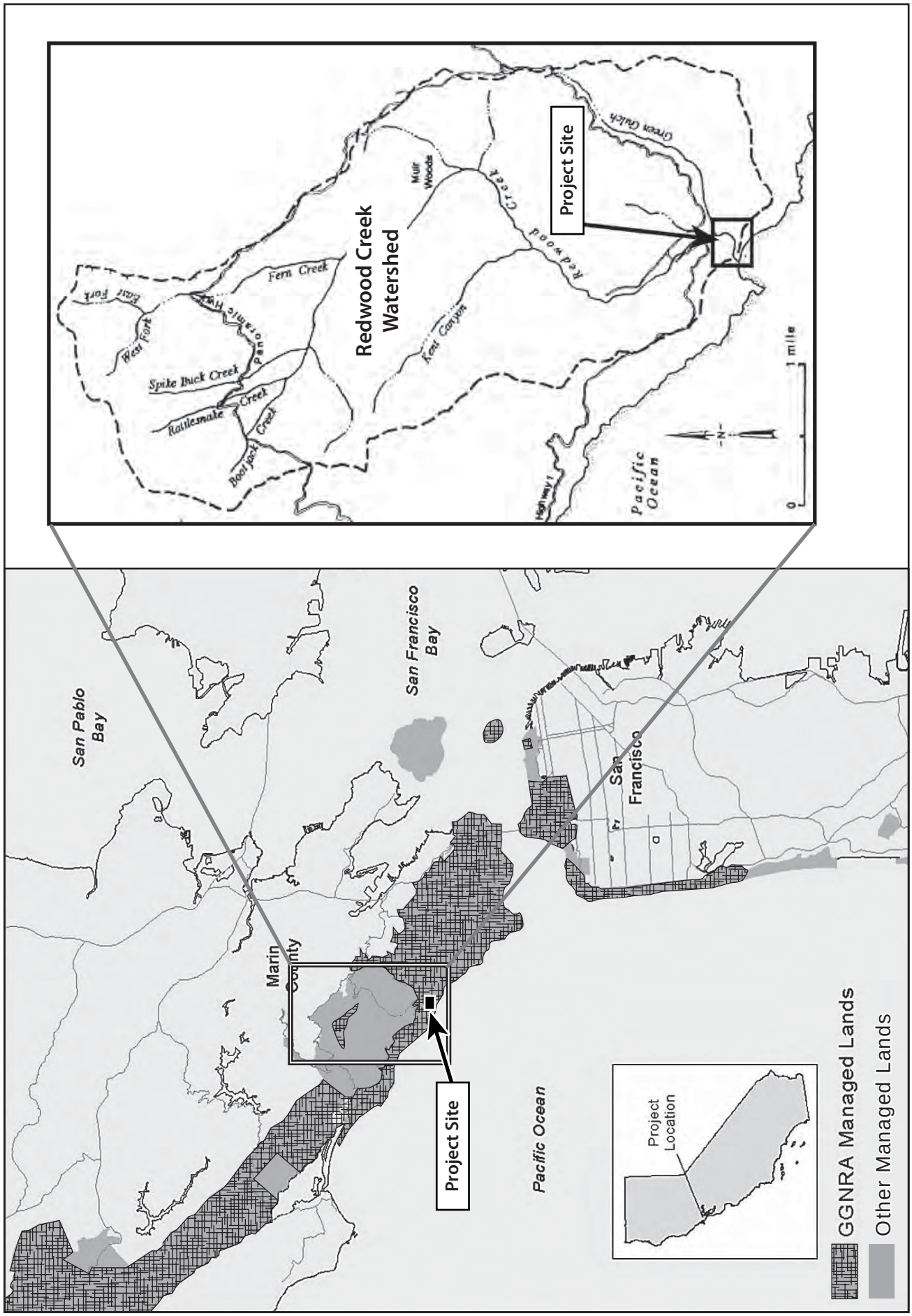


Figure ES-1
Project Location

Jones & Stokes

050520.5 EIR/EIS (rev 12-07)

Exhibit 2: Final Environmental Impact Statement

Preliminary Environmental Assessment of Wetland Restoration Alternatives for Big Lagoon, at Muir Beach, Marin County (PWA et al. 1994) was prepared describing Restoration Alternatives. Three of the conceptual Restoration Alternatives entailed creation of a freshwater lagoon at the site, and one entailed expansion of the intermittent tidal lagoon. The proposed freshwater lagoon alternatives ranged from 7.9 to 16.2 acres of open water, with required excavation ranging from 50,000 to 120,000 cubic yards of material. The intermittent lagoon excavation entailed about 3,600 cubic yards of excavation.

The Preliminary Environmental Assessment identified six locations in the Redwood Creek watershed as potential disposal sites for the excavated fill material. These included most of the 28-acre former agricultural field at the Banducci site, the Franks Valley riding ring area on State Parks land, and the lower portions of Green Gulch Farm closest to the project area. Following completion of the Preliminary Environmental Assessment, NPS put the Big Lagoon restoration project on hold because Caltrans dedicated its Lone Tree Slide mitigation funds to help NPS purchase 563 acres of the Giacomini Ranch at the southern end of Tomales Bay for future wetland restoration.

Additional planning for the Big Lagoon project did not resume until 2002, when GGNRA secured funds for this purpose from the NPS Recreation Fee Demonstration program and the California Department of Fish and Game Fisheries Restoration Grant program. While current planning efforts have drawn substantially from earlier data and analyses, agency planners have made the following modifications to key planning elements:

- The original 1994 project boundary was expanded to include 6.75 acres of NPS land upstream of Pacific Way. This wooded area extends from Hwy 1 on the east to Redwood Creek on the west and borders property owned by the Pelican Inn. The expanded boundary allows Restoration Alternatives to incorporate a more integrated approach to creek realignment.
- The NPS visitor parking lot was added as a project feature to be modified to reduce its hydraulic impacts.
- A new range of Restoration Alternatives was developed.
- The Pacific Way road and bridge, owned by Marin County, were added as project action elements, and Marin County became a project partner. A range of alternatives for a new bridge was developed.
- Many previously considered fill disposal sites were eliminated from further consideration due to potential impacts on wetlands or other natural hydraulic functions.

The current planning effort is also working under a different set of management conditions and constraints compared to those in 1992–94. Some of the primary changes are as follows:

- The U.S. Fish and Wildlife Service (USFWS) listed coho salmon, steelhead trout, and the California red-legged frog, which all occur at the site, as threatened species on the federal Endangered Species List in 1996. USFWS

has recently changed the status of coho salmon from “threatened” to “endangered.”

- Project managers have more information regarding the quantity of summer creek flows. Under normal to dry years, with existing upstream permitted water diversions, the summer habitat for salmonids in the project area is poor on a more frequent basis because of poor water quality and insufficient flow (PWA 2004). Therefore, this project did not identify a primary objective to enhance summer rearing habitat, although it will still make such enhancements where possible. This project does identify primary objectives to enhance winter and early spring rearing habitat for salmonids.
- Project managers better understand current sediment loads and sediment sources from the watershed in relation to historic sediment loads (Stillwater Sciences 2004). The additional data have facilitated a more specific analysis of the function and longevity of Restoration Alternatives than was available previously.
- Flooding on Pacific Way has grown worse, with more frequent flooding during small events when flooding generally does not occur elsewhere in Marin County.
- Confined reaches of Redwood Creek identified in the early 1990s became more obstructed due to sediment deposits, and the creek lost significant conveyance capacity by the late 1990s. The creekbed aggraded, causing groundwater in the adjacent pasture to also rise. Cattails became established on the Green Gulch pasture that had been formerly grazed by horses.

Role of Lead Agencies

This project has two lead agency sponsors, the County and NPS. Although it is a joint project, the County and NPS each play a unique role in the project. The County’s role is limited to actions related to improvements to Pacific Way and the Pacific Way Bridge, with a joint role with NPS for interim flood reduction actions. All other actions are the responsibility of NPS. All components of the project are related and necessary to achieve the overall goals and objectives of the project; for this reason, they have been included as the whole of the project.

Project Purpose and Need

Project Purpose

The purpose of the proposed action is to restore a functional, self-sustaining ecosystem, including wetland, riparian and aquatic components and to conduct the restoration in a manner that will re-create habitat for sustainable populations of special status species, reduce flooding on Pacific Way, and provide a compatible visitor experience.

Project Need

Loss of Natural Creek Function

Human modifications in the project area are so extensive that not only does its most prominent original landscape feature—a big lagoon—no longer exist, but Redwood Creek and its associated floodplains, wetlands, and aquatic habitat have steadily lost their natural function. In particular, the ability of the creek to convey high flows to the ocean, carry sediment loads, support rearing habitat for federally-listed salmonids, and flow naturally on floodplains is severely diminished. The landscape once defined by a lagoon that stretched from today's Hwy 1 to the beach is now highly fragmented, both visually and functionally. Redwood Creek is confined by a levee, a public road, a small bridge, and a parking lot, and its natural processes are limited by structures in the floodplain. Landowners installed these features between the 1920s and the 1980s to improve the land for agriculture, recreation, residential access, and commercial enterprises, but the cumulative effect is that the creek in its altered state functions poorly for even its most fundamental purpose of conveying routine winter flows and transporting sediment loads. The most visible consequence of the diminished natural function is the increased frequency of flooding on Pacific Way, which causes road closures at least annually. More details related to this issue can be found in Chapter 3, Section 3.1.1, *Watershed Processes.* This project is needed to restore a functional, resilient ecosystem while also providing habitat for special-status species and reducing flooding on Pacific Way.

Hydraulic Obstruction from Parking Lot and Levee

Muir Beach is a very popular coastal attraction for San Francisco Bay Area residents, but its convenient parking lot is a notable obstruction to a functional creek system. The NPS parking lot and adjoining picnic area, serving about 260,000~~440,000~~ visitors per year, are built on a fill pad three to four feet higher than the adjacent floodplain. The 500 foot–long fill pad extends prominently across the valley, leaving only about 50 feet of width for the creek and its floodplain. High winter flows from an 8.9-square mile watershed from the top of Mt. Tamalpais must wash through this remnant narrow passage to reach the natural end point at the ocean, but the passage is too restrictive. The opposite side of the creek is also confined by a levee built during the 1960s agricultural era. In the approximately 25 years since the parking lot fill pad was built, high flows have been obstructed routinely upstream of the parking lot, causing large loads of sediment that would have otherwise been carried to the ocean to be deposited in the creek and riparian area upstream of the parking lot. The creek upstream of the parking lot filled with such large volumes of sediment that it lost its channel definition; excess fine sediment buried the whole floodplain between the parking lot and levee road. Fences installed in the 1960s are buried in sediment up to the top of the fence posts. This rapid sedimentation of the creek upstream of the parking lot has raised portions of the creekbed to elevations higher than the adjacent Green Gulch pasture. This is a geomorphologically unstable condition with a high risk for channel avulsion, which could cause a sudden migration of

the stream channel into the lowest position in the valley. Because it is a substantial hydraulic obstruction, the current parking lot configuration, primarily the lower 90 feet of the parking lot, is not compatible with a functional fluvial system. Yet, with a high visitor demand, the project is needed to provide both public access and a visitor experience that is compatible with ecosystem restoration. More details related to this issue can be found in Chapter 3, Section 3.1.1, *Watershed Processes.*

Diminished Habitat for Salmonids

Redwood Creek is the southernmost stream in the United States with a healthy population of coho salmon, but its numbers are significantly lower than those of historic populations. Coho in the central coast of California are now formally listed by both the state and federal governments as endangered, and resident steelhead trout are listed as threatened. The habitat in the project area has been diminished both in its areal extent and its quality, with the loss of historic creek and floodplain habitat through landscape modifications. Floodplains are known to provide important habitat for outmigrant coho to feed and build body mass, thereby increasing their chance of survival upon returning to the ocean. Fish passage from the project area's biggest floodplain may be impaired, however, because a 1,300 foot–long levee across the site provides only two culverts back to the mainstem channel, one of which routinely fills with sediment and requires maintenance. Large woody debris that naturally falls in the main channel and maintains pools with cover is currently removed periodically to facilitate sediment passage and reduce flooding impacts on human development, and sediment has been periodically excavated from the channel. The existing channel conditions led to this conflict between managing for protection of natural resources and managing for flood reduction. More details related to this issue can be found in Chapter 3, Section 3.2.3, *Biological Resources*. This project is needed to regain vital habitat, particularly winter rearing habitat, for federally listed salmonids.

Flooding on Pacific Way

Muir Beach residents and GGNRA visitors access the site via Pacific Way, a Marin County road with a small bridge spanning Redwood Creek. However, water flows over the road routinely each winter, even when other county roads in low lying areas remain passable. Water depths can reach two to three feet in moderate rain events. This problem has grown noticeably worse in the past two decades as the confined creek has accumulated sediment and lost conveyance capacity. The creek upstream of the Pacific Way Bridge was measured to be about five feet deeper ten years ago; today's shallower creek causes more water to wash over the floodplain and across the road during even minor flood events. The problem, however, is not a matter of keeping the creek deep enough to pass high flows; the problem is that the road is on a floodplain that will always flood under some events and residents now depend on the road for year-round access. The road was originally built across the floodplain in the 1920s, with a small

bridge over the creek, which was apparently repositioned to the side of the valley. The road sits atop an area that was underwater—a part of the "big lagoon"—in the 1853 U.S. Coast Survey map, and it was remapped in 1892 as a marsh with multiple drainage channels. The road was originally not intended for year-round use, but for access to a tavern and cottages for summer use. The next road upstream from the project area (Hwy 1, to the north) was also built across the floodplain and was also inundated periodically until Caltrans raised the road elevation in the 1970s. The Caltrans solution of raising the road across the entire floodplain cannot be applied to Pacific Way, because structures are now built in the floodplain very close to the road. A higher road all the way across the floodplain, with a small bridge only at one end, would effectively dam the creek during higher flows, and cause an increase in flood elevations at the structures. Some of these structures, such as the Pelican Inn and AT&T utility boxes, sit on fill pads that have collectively reduced the available floodplain width by about 40%, or by about 200 feet out of a maximum of about 475 feet of floodplain width. While the history of development has had an impact on creek and natural function, the dependency on the road for residential access has created the necessity of reducing flooding on Pacific Way, but this project is needed to provide public access in a manner that is compatible with a natural, resilient fluvial system. More details related to this issue can be found in Chapter 3, Section 3.1.1, *Watershed Processes.*

Unsustainable Frog Habitat

California red-legged frogs (CRLFs) occur at the project site in a habitat that is maintained by the same structures that make the overall creek system dysfunctional. The 1,300 foot–long levee built in the 1960s to confine the creek also allows water to pond in the Green Gulch pasture. Emergent vegetation grows in the ponded water, providing suitable breeding habitat for the frogs. However, the ponding is dependent on NPS maintaining flashboards on a culvert under the levee each spring and managing it to make sure that water stays ponded long enough to allow successful CRLF reproduction. The number of frogs at the site is so low that their continued existence is in jeopardy, and yet their current habitat is reliant on both human management and a constructed levee that contributes substantially to larger ecosystem dysfunction. There are no other known populations of CRLFs in the Redwood Creek watershed, and as such there is an urgent need to provide hydrologically sustainable habitat CRLFs in this watershed. More details related to this issue can be found in Chapter 3, Section 3.2.2, *Wildlife and Wildlife Habitat.*

Summary

This project is needed to address the extensive loss of natural function for channel conveyance, sediment transport, channel stability, and diminished habitat for federally endangered coho and federally threatened steelhead; the increased flooding on Pacific Way; and the critical need for sustainable habitat for the CRLF. With many of the impacts resulting from facilities that have

accommodated public and residential access, public access is needed in a manner that is compatible with ecosystem function.

Goals

This project will conduct ecological restoration and public access improvements at Big Lagoon to meet the following goals:

- Restore a functional, self-sustaining ecosystem, including wetland, aquatic and riparian components;
- Develop a restoration design that (1) functions in the context of the watershed and other pertinent regional boundaries, and (2) identifies and, to the extent possible, mitigates factors that reduce the site's full restoration potential;
- Consistent with restoring a functional ecosystem, re-create and maintain habitat adequate to support sustainable populations of special status species;
- Reduce flooding on Pacific Way and in the Muir Beach community caused by human modifications to the ecosystem, and work with Marin County to ensure that vehicle access is provided to the Muir Beach community;
- Provide a visitor experience, public access, links to key locations, and resource interpretation that are compatible with the ecosystem restoration and historic preservation;
- Work with the Federated Indians of Graton Rancheria to incorporate cultural values and indigenous archaeological site resources into the restoration design, visitor experience, and site stewardship;
- Provide opportunities for public education and community-based restoration, including engaging local and broader communities in restoration planning and site stewardship; and
- Coordinate with local transportation planning efforts to identify project features that are compatible with transportation improvements and consistent with the ecosystem restoration.

The project is considered self-sustaining if it does not require routine maintenance, but landforms in the area may still change substantially compared their constructed forms.

A list of 34 specific objectives to meet these goals is provided in Table 1-1, Project Objectives and Indicators for Big Lagoon Restoration, in Chapter 1.

Alternatives

This Final EIS/EIR evaluates three alternatives for ecological restoration, six alternatives for public access, and four alternatives for a new Pacific Way Bridge and road, in addition to the No Action Alternative (no restoration and no changes to public access or bridge construction). The conceptual designs for these alternatives were developed by Philip Williams and Associates and John Northmore Roberts through an iterative process between NPS, Marin County, and the SFZC and through a series of public meetings of the Big Lagoon Working Group held in 2003 and 2004.

Alternatives were described in the Feasibility Analysis (PWA 2004), but the Restoration, Public Access, and Bridge Alternatives have all undergone some conceptual design refinements since 2004 to reduce their environmental impacts and enhance their benefits.

Alternative 1—No Action

Under the No Action Alternative, Redwood Creek would remain in its current alignment, and no large-scale physical modifications of the site would occur. Pacific Way road and bridge would remain unchanged in size and design and would continue to serve as the primary access route to the parking lot, which would also remain unchanged at its current location, as well as for residences along Pacific Way and Lagoon Drive. The No Action Alternative would allow for the continued periodic flooding of Pacific Way during storm events, resulting in the need for emergency intervention to prevent prolonged road closures. Periodic maintenance, including dredging, would continue to be needed to remove sediment and fallen trees from Redwood Creek, although its implementation would be hindered by the difficulty in obtaining permits from regulatory agencies for such actions. Channel avulsion of Redwood Creek (i.e., sudden relocation of the channel alignment during a large storm) would be likely under this alternative because the existing channel, in its confined condition, continues to aggrade (i.e., build up with sediment) in response to elevated sediment delivery from the watershed. Active seasonal management of the culvert and flashboards in the lower Green Gulch pasture would continue to be necessary to maintain ponded surface water for the CRLF.

Action Alternatives

Activities Common to All Action Alternatives

Restoration Activities Common to All Action Alternatives

The activities common to all Restoration Alternatives would be as follows:

- **Interim Flood Reduction Measures.** Interim flood reduction measures consist of excavating the Redwood Creek channel from a maximum of about 400 feet upstream of the Pacific Way Bridge to about 100 feet downstream of the bridge. Actions may be performed once, or repeated on a more limited basis if needed. Interim actions would include removing log jams in the project area only if they are shown to be obstructing flood flows or contributing to sediment aggradation that is worsening flooding or the risk of channel avulsion. These measures would be performed during the interim period prior to implementation of the Restoration and Bridge Alternatives, which may not be completed until 2010 or 2011.
- **Relocation of Redwood Creek Channel.** For each action alternative, the Redwood Creek channel from the upstream project boundary to approximately 100 feet downstream of Pacific Way would generally be relocated to the topographically lowest portion of the valley; because this low point is very close to the Pelican Inn, the new channel would be located approximately 150 feet from the Pelican Inn driveway at Pacific Way. Most of the existing channel would be filled upstream of Pacific Way under Alternatives 3 and 4, but most of this reach would not be filled under Alternative 2 to create a backwater channel for use by salmonids and to increase flood storage capacity.
- **Construction of New Drainage Swale and Upper Pasture Modifications.** Under all restoration approaches, a drainage swale would be constructed downstream of Pacific Way between the realigned creek channel and the eastern project boundary. Fencing around an equestrian ring on the southwestern side of the access road would be removed under all alternatives, and the area would be revegetated with seasonal wetland vegetation.
- **Backbeach Lagoon Enhancement, Channel Realignment, and Dune Restoration.** All action alternatives would include excavation to expand the potential natural variation in the intermittently tidal lagoon along its landward side, and installation of large woody debris (LWD) in the lagoon or at its edge to enhance habitat for juvenile steelhead and salmon. The stream channel downstream of the existing footbridge would be shifted seaward from its existing location to an alignment consistent with an 1853 map and early aerial photographs of the site. Finally, dune enhancement would occur through the possible natural lowering of the water table, combined with wind activity to develop dunes from newly dry (hence, erodible) sands. Fencing or other means would be used to restrict public access to dune restoration areas, and revegetation of native dune vegetation may be implemented to improve dune formation and quality. The removal of most fill shoreward of the parking lot where kikuyu grass occurs would be scraped about 1 foot deep, creating additional wetlands in the short-run and, possibly converting to dunes in the long-run with the build-up of wind-blown sand. Fill may be newly placed on a small portion of the area immediately adjacent to the reconfigured parking lot to function as a picnic area.
- **Removal of Levee Road**. The 1,300 foot–long levee road would be removed under each action alternative to allow lateral channel migration and to reconnect Redwood Creek to the floodplain.

- **Invasive Species Removal.** All action alternatives would involve removal of invasive non-native plant species, both during the construction phase and throughout the lifetime of the project. In particular, Cape ivy, Himalayan blackberry, non-native invasive perennial grasses, such as kikuyu grass, Harding grass, and tall fescue, and other non-natives would be removed from various locations at the project site. Non-native species outside the project boundary that would be likely to spread to the project site would also be targeted for removal.
- **Removal of Tavern Remnants.** Remnants of the Muir Beach Tavern between the parking lot and the mouth of Redwood Creek/inboard end of the tidal lagoon, in the southwest portion of the project site, would be removed. ~~including a buried retaining wall and a chimney~~. This would include removal of the buried retaining wall; however, the chimney would remain in place.
- **Removal and Relocation of Utility Lines.** Each action alternative would involve the removal and relocation of water, phone, and electric lines along the levee road and/or near Pacific Way. Existing AT&T utility boxes would be relocated, and a decommissioned well pump adjacent to the levee road and associated above-ground power lines across Green Gulch pasture would be removed.
- **Removal of Concrete Channels and Revetment.** Gabions and other channel armoring upstream of the existing footbridge would be removed to allow the restored channel to migrate more naturally. In addition, concrete channels along Green Gulch Creek and the unnamed tributary in the project area would be removed, as would the concrete weir structure controlling flows between the existing emergent wetlands and Redwood Creek channel and the culvert from Green Gulch Creek under the levee road to Redwood Creek.
- **Modifications to Green Gulch Field 7.** The windrow of Monterey cypress trees on the southwest edge of the field would be removed. Fencing around the perimeter of Field 7 would be adjusted to reflect the new project boundaries. An existing horse shelter would be relocated in the new boundary of Field 7.
- **Application of Traditional Ecological Knowledge.** A traditional ecological knowledge study will be prepared in consultation with the Federated Indians of Graton Rancheria to compile and analyze the archaeological, ethnographic, and ethnohistoric data available to inform the restoration design, revegetation, and interpretation of the site.
- **Removal of Lower End of Existing Parking Lot and Picnic Area.** All restoration alternatives incorporate the removal of at least the southeast end of the existing parking lot, including the picnic area, to improve hydraulic conveyance of the creek. At least 90 feet of the parking lot would be removed. Public Access Alternatives evaluate a range of options for the new parking lot and picnic area design.
- **Mosquito Management.** Information would be provided to visitors and residents on how to reduce exposure to mosquitoes (e.g., wearing long-

sleeved shirts). Monitoring for larval mosquitoes will occur when surface water is present. Should numbers be present at levels sufficient to pose public health risks, the Park's IPM coordinator will treat the ponded areas. In the long term, colonization of the created wetland habitat by predatory insects should also assist with reducing the risk posed by mosquitoes.

Public Access Activities Common to All Action Alternatives

The activities common to all Public Access Alternatives would be as follows:

- **Pedestrian Access from Hwy 1.** A pedestrian trail, accessible by persons with disabilities, would be constructed along Pacific Way from Hwy 1 to the beach parking lot/drop-off. The portion of the trail closest to the parking lot would be separated from the road by up to a 5 foot–wide buffer, and could also be grade-separated from the road by approximately 1 foot.
- **Pedestrian Access to Beach.** The pedestrian boardwalk and bridge crossing from the new parking lot to the beach would be relocated to a location where its e~~a~~ffects on channel function are minimized.
- **Interpretive Displays.** Interpretive displays would be installed at the parking lot or drop-off, and at the intersection of the Coastal Trail and Green Gulch Trail. Public Access Alternative C would include an additional interpretive display at the Alder Grove parking lot. In addition, an interpretive blind/overlook for bird watching could be constructed.
- **New Emergency Access Route.** The existing road along the eastern edge of the site would be upgraded to serve as emergency access route from Pacific Way to the southern project boundary. This route would replace the levee road for access to the Coastal Trail and Coyote Ridge. The road would remain unpaved and the existing alignment would not be altered, but vegetation that has grown over the edges would be removed to extend the width of the road to 11 feet to accommodate emergency access vehicles. A bridge crossing at the southern end of the Green Gulch pasture would be improved to facilitate vehicle passage.
- **Interpretation.** Interpretive facilities would be provided during construction, including interpretive signage and possible kiosks located at strategic locations. Interpretation will also be an on-going activity at the site into the future.

Restoration Alternatives

The Restoration Alternatives are as follows:

- **Alternative 2—Creek Restoration.** Alternative 2 would involve relocating approximately 2,500~~2,000~~ linear feet of Redwood Creek to the topographically lowest portion of the valley, while maintaining a habitat mix

similar to current conditions. Creek relocation and restoration would be designed and graded to remove existing hydraulic constraints and minimize the need for ongoing maintenance. The new channel would include low sloping banks slightly higher than the adjacent floodplain to simulate the natural depositional levees that would occur in this reach. These low berms upstream of Pacific Way would accommodate bankful flows, maintain the low flow channel, and support riparian vegetation, thus increasing sediment transport and channel sustainability. Downstream of Pacific Way, the channel would be designed to accommodate more frequent out-of-bank flows of at least a 1-year frequency to create frequent floodplain habitat for salmonids. Most of the existing primary channel of Redwood Creek upstream of Pacific Way would not be backfilled in order to retain its function as backwater habitat. Several other backwater features downstream of Pacific Way would also remain unfilled, and new backwaters would be excavated and connected to the new channel. The area adjacent to the backwaters will be graded to expand available floodplain habitat during base and peak winter flows.

Two areas would be excavated to create emergent wetland habitat. One emergent wetland area would be in the upper pasture, and the other emergent wetland area would be adjacent to the Green Gulch tributaries, but outside the boundaries of existing cattail habitat. The excavated wetland areas would have gradual slopes to provide suitable habitat conditions for the CRLF under the expected range of groundwater levels. The two tributaries from Green Gulch would be realigned and allowed to dissipate into the newly excavated wetland, mirroring historic conditions in which the Green Gulch drainage was not connected to the main channel. Concrete lining in the southern-most Green Gulch drainage channel would be removed.

- **Alternative 3—Creek and Small Lagoon Restoration.** Alternative 3 would combine riparian restoration components with restoration of open water and wetland habitats. Under Alternative 3, two open-water lagoons would be created, one on either side of the new channel. The two small lagoons would be backwaters, connected to the creek near the downstream end of each lagoon. The banks of the lagoons would have varied slopes to favor a variety of habitats. The lagoons would maintain a minimum water depth of 3–4 feet year-round.
- **Alternative 4—Large Lagoon Restoration.** Alternative 4 would create a periodically brackish open-water habitat similar to historic (1853) conditions, modified to reflect existing constraints of Pacific Way and private property. This alternative would involve the creation of a large lagoon with fringing wetlands extending to the edge of the valley immediately landward of Muir Beach. The lagoon would be excavated with gentle side slopes to encourage colonization of emergent wetland vegetation. Like the small lagoons under Alternative 3, the large lagoon would maintain a minimum water depth of 3–4 feet year-round.

Public Access Alternatives

The Public Access Alternatives are as follows:

- **Alternative A—No Action, 175 Cars at Beach.** Under the No Action Alternative, the parking lot would retain is 175-car capacity and current configuration.
- **Alternative B1—50 Cars at Beach.** Public Access Alternative B1 would construct a 50-space parking lot at the beach at the site of the existing parking lot.
- **Alternative B2—145 Cars at Beach.** The parking lot under Public Access Alternative B2 would retain the same footprint as the existing parking lot, but the lower 90 feet would be removed to accommodate a maximum of 145 vehicles.
- **Alternative B3—175 Cars at Beach.** Public Access Alternative B3 would accommodate a maximum of 175 vehicles, the same number as the existing parking lot. The lot would be about the same size as the existing parking lot, but it would be pulled back from the creek further than the minimum 90 feet to create a minimum distance of about 180 feet from the creek. It would expand further northward into existing riparian habitat.
- **Alternative B4—175 Cars Rotated Parallel to Pacific Way.** The parking lot under Public Access Alternative B4 would have the same 175-car capacity as Alternative B3, but would be rotated parallel to Pacific Way. The lot would include a new turn-off from Pacific Way and would include 310 linear feet of stacking room for cars between the entrance and the first parking stall. The distance of the parking lot from the creek bank would be about 350 feet.
- **Alternative B5—200 Cars at Beach.** Public Access Alternative B5 proposes the largest parking lot of all the alternatives, with a maximum of 200 vehicle spaces. The parking lot would be located in the same area as Alternatives B4, but would be larger.
- **Alternative C—118 Cars at Alder Grove plus 14 Disabled-Accessible Parking Spaces and Drop-off at Beach.** Under Public Access Alternative C, a new parking lot would be constructed at Alder Grove along Hwy 1, north of Pacific Way. This parking lot would accommodate a maximum of 118 vehicles. Pedestrians would walk the 0.5 mile from the lot to the beach on a new trail through the alder grove that would be developed as part of this alternative. Additionally, an area within the footprint of the existing parking lot at the beach would accommodate 14 parking spaces for persons with disabilities and a drop-off/turnaround. The parking lot would be generally visible from Hwy 1 through a 25 foot–deep screen of trees.

Bridge Alternatives

All action alternatives have a consistent deck width that will be designed ~~between a total~~ up to a maximum of 30 to 32~~6~~ feet, including the width of a pedestrian trail and railings, and a bridge deck approximately 2 feet thick. The road approach would consist of a road, including embankments, up to 34 feet wide. Portions of raised roads would have embankments extending from the road at a 3:1 slope, expanding the road footprint. The pedestrian trail would be built atop the embankment on the south side of the road.

All alternatives would be designed to be aesthetically compatible with site character, meet Marin County's bridge standards, include a disabled-accessible pedestrian path on the downstream side, and contain rails that minimize blockage of infrequent high stream flows which could overtop the bridge deck.

The Bridge Alternatives are as follows:

- **Alternative BR0: No Action.** The No Action Alternative has been described previously above; the existing bridge has an approximately 24-foot span with a deck elevation of 15.2 feet National Geodetic Vertical Datum (NGVD).
- **Alternative BR1: 50 foot–long bridge with a raised road.** The short bridge spans the 35 foot–wide channel with a deck at 16.5 feet NGVD. To provide vehicular access to the deck that would have a similar level of flood protection as the bridge, the elevation of the north and south approaches would be raised. At the lowest point of the road, the elevation gain would be up to about 5 feet to 15.5 feet NGVD. The bridge would be free-span and would not need supporting piers.
- **Alternative BR2: 50 foot–long bridge with a low road.** Similar to Alternative 1, this short bridge spans the 35 foot–wide channel. The deck height, however, is lower at approximately 15 feet NGVD (similar to the existing bridge) and would not require extensive elevation changes for the approach. The bridge would be free-span and would not need supporting piers. The existing road on each side of the bridge would remain at its current elevation.
- **Alternative BR3: 150 foot–long bridge with raised road.** This bridge would be longer than Alternatives BR1 and BR2 and would span both the new 35 foot–wide channel and areas of riparian habitat and floodplain on either side of the channel. The bridge span would provide for approximately the same available floodplain passage as the existing condition, which is currently defined by the area between the Pelican Inn fill pad and a fill pad for AT&T utility boxes, which together eliminate about 200 feet of floodplain width. For purposes of analysis, it is assumed that 2 foot–wide piers, placed at approximately 40-foot intervals, would be used to support the span and allow for channel migration. The bridge height would be about 16.25 NGVD. The road approach north and south of the bridge would be raised to a maximum of about 14.5 NGVD to provide a similar level of flood protection as the bridge. The raised road approach would begin at Hwy 1 and be about 2 feet higher than the current entrance to the Pelican Inn.

- **Alternative BR4: 250~~266 to 300~~ foot–long bridge with highest road.** This alternative would be the longest bridge, and would span the entire available riparian zone and floodplain from the Pelican Inn on the north to the existing bridge on the south. This bridge would have the highest deck of all the alternatives, between 16.25 ~~feet~~ and 18 feet NGVD, compared to the elevation of Hwy 1 at about 16.5 NGVD (i.e., the bridge would be between 0.25 feet lower and 1.5 feet higher than Hwy 1). For purposes of analysis, as in Alternative BR3, two foot–wide piers, placed at approximately 40-foot intervals, would be used to support the span and allow for channel migration. The BR4 Alternative is slightly reduced in length (from 266–300 feet to 250 feet) compared with the alternative described in the Draft EIS/EIR. This shortening is a minor technical change that, pursuant to CEQA Guidelines 15088.5, does not require recirculation of the Draft EIS/EIR prior to certification.

Fill Disposal Alternatives

The Restoration and Public Access Alternatives would generate various amounts of fill as a result of excavation during restoration and construction. Fill would be reused on site where possible to reduce the need for off-site use or disposal. The Fill Disposal Alternatives are as follows:

- **Unused Reservoir Pit.** An unused reservoir pit on NPS property north of the site, near Hwy 1 has a storage capacity of about 23,800 cubic yards of material. The pit is located on the hilltop adjacent to the portion of the Coastal Trail north of the Muir Beach overlook, and is not visible from Hwy 1. The surface layer would be capped with several inches of fine soil to promote native plant revegetation. The approximately 0.75 mile haul route to this site would follow Hwy 1 north of Pacific Way, past the Muir Beach Overlook. Trucks would turn off of Hwy 1 onto the Coastal Trail to reach the reservoir. An area would be cleared near the pit to allow for truck turnaround.
- **Upper Banducci Field.** The flat field on NPS property north of Hwy 1 and adjacent to Redwood Creek could accommodate approximately 4,000 cubic yards of material, with material placed at least 200 feet from the Redwood Creek in the only portion of the site that is not a jurisdictional wetland and is furthermore highly disconnected from the floodplain. In addition, the site could be used as a temporary stockpile location for material that must be removed from the project site quickly but would not be hauled out of the watershed until a later time. The 0.5 mile haul route to the site follows Hwy 1 north from Pacific Way to the gravel driveway adjacent to Redwood Creek and the Hwy 1 bridge. Trucks would travel down the driveway, cross an intermittent tributary that would be temporarily filled, and up the field for disposal of compost or stockpiling of fill in the upper portion of the site.
- **Hamilton Air Force Base Wetland Restoration.** The U.S. Army Corps of Engineers (USACE) and the California Coastal Conservancy (CCC) are jointly conducting an extensive wetland restoration project at the former Hamilton Air Force Base in Novato, California. Due to subsidence of the

former wetland, vast quantities of fill material are needed to restore the wetlands fringing San Francisco Bay. While most of the fill for the Hamilton project will be dredge material imported by barge, the project could accept large quantities of clean fill transported by truck. The largest quantity of fill that could be generated by any of the three Big Lagoon project alternatives, about 191,000 cubic yards of material, could be accepted for use at the Hamilton wetland restoration project. Potential environmental impacts or benefits of fill placement at the Hamilton wetland restoration site have been addressed by the Final EIS/EIR prepared for that project; hence, the analysis in the current Final EIS/EIR is restricted to an evaluation of hauling trips. The approximately 20-mile haul route to this fill site follows Hwy 1 south from the site to Tam Junction in Mill Valley for approximately 7 miles, and then north on U.S. Highway 101 (US-101) about 13 miles.

- **Dias Ridge Trail Recontouring.** The Dias Ridge Trail extends from Panoramic Highway through Tamalpais State Park lands to NPS lands to the south, and ends on Hwy 1 south of Muir Beach. It currently has numerous gullies, thru-cuts, and head-cuts. NPS and Tamalpais State Park are currently planning a project to recontour the trail, and up to about 24,000~~4,000~~ cubic yards of material of the appropriate consistency from the Big Lagoon project may be used to recontour the trail. The Dias Ridge Trail project is being addressed through separate NEPA documentation; hence, the analysis in the current Final EIS/EIR is restricted to an evaluation of hauling trips. The 2.5-mile haul route from the Muir Beach project site to Dias Ridge follows Hwy 1 south to the intersection with Panoramic Highway (aka Three Corners) and up Panoramic Highway to the turn-off onto the Dias Ridge Trail.
- **Coastal Trail Recontouring, South of Site.** The poor alignment of the Coastal Trail south of Muir Beach to Coyote Ridge promotes erosion. Approximately 2,500 to 4,000 cubic yards of material from the Big Lagoon project may be used to recontour the trail. The haul route to this site would not require travel on public roads. Trucks would travel over the levee road or new emergency access road to the Coastal Trail intersection, then up the hill to trail recontouring locations between Muir Beach and Coyote Ridge. The total distance from the project site to Coyote Ridge is 0.74 miles. Because the specific locations for trail recontouring have not been identified at this time, and because the Coastal Trail in this area will be the subject of a future Determination of Eligibility for listing in the National Register of Historic Places, the analysis of this site is limited and only addresses the effects of haul trips and the typical effects of trail recontouring. Should the recontouring project move forward, it would be the subject of a subsequent NEPA analysis.

Preferred Alternatives

The preferred alternative consists of Restoration Alternative 2 (Creek Restoration), Public Access Alternative B4~~B3~~ (a 175-car parking lot at the beach rotated parallel to Pacific Way~~that is pulled back from the creek more than the minimum 90 feet and builds into the adjacent riparian area~~), and Bridge Alternative BR4~~BR3~~ (a 250~~150~~ foot–long bridge with a raised road at each end).

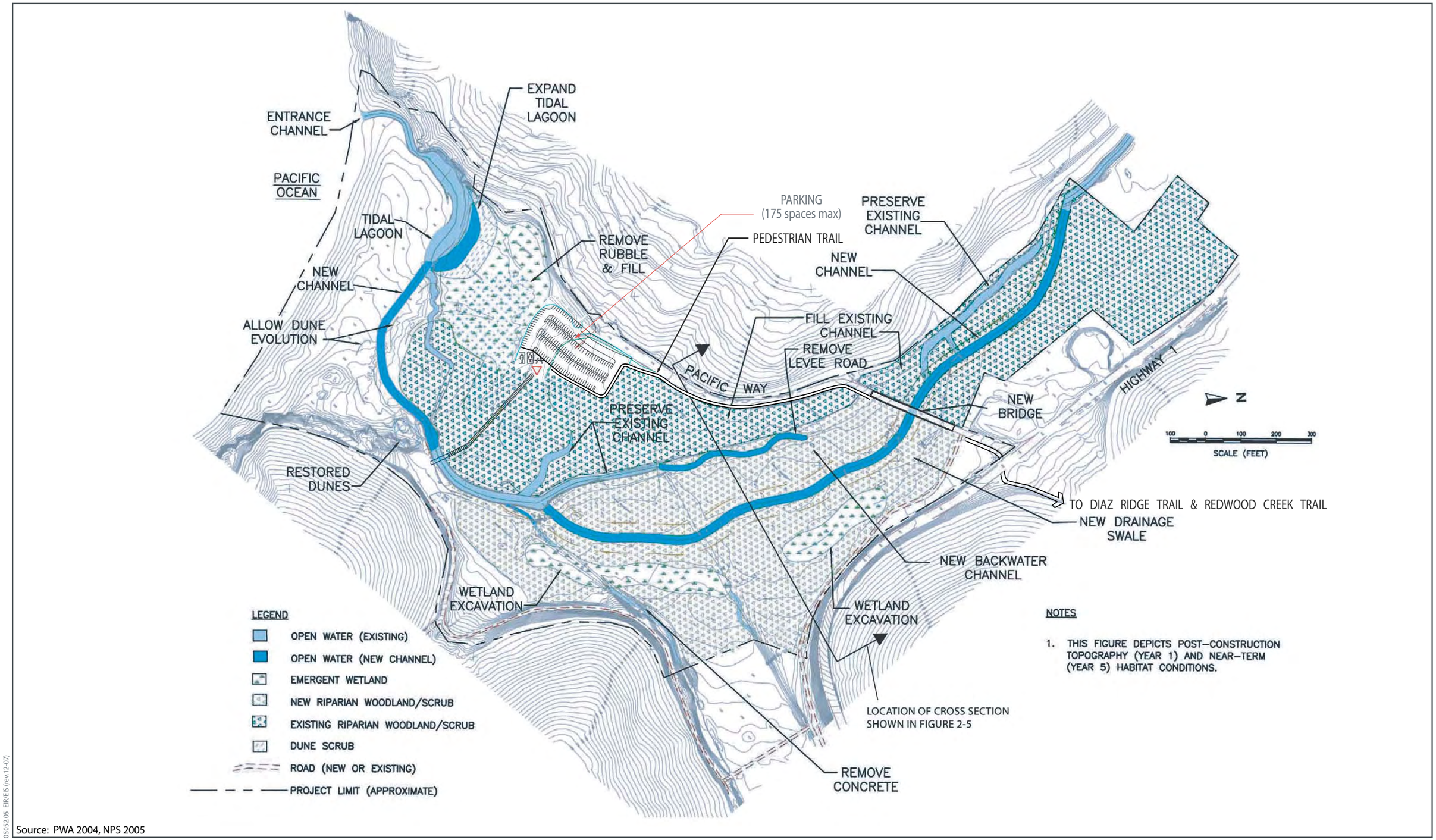
This set of preferred alternatives is shown in Figure ES-2. Fill material will be disposed of at the Unused Reservoir Pit about 2 miles north of the project site, and vegetative material removed for construction will be composted in piles on the Upper Banducci Fields. Some suitable fill material may also be used for the Dias Ridge recontouring, or possible Coastal Trail recontouring, if it is available, but all material would be used or safely deposited within the watershed. This combination of project features is consistent with the NPS mission, offers the best combination of project benefits, including factors related to both the project's purpose and need and its impacts, as follows:

- It will restore a functional, self-sustaining ecosystem to the maximum extent of any of the alternatives.
- It will support sustainable populations of existing special status species and improve their habitats.
- It will provide for vehicle access for the Muir Beach community and reduced flooding on Pacific Way.
- It will provide a visitor experience that is compatible with ecosystem restoration and historic preservation.
- It will have a relatively small construction footprint, relatively short construction duration, and will minimize construction-related impacts such as dust, noise, and the need to haul and dispose of fill.
- ~~It will be substantially less costly than other alternatives, which could have provided only marginally greater environmental benefits.~~

Identifying the Preferred Alternative

As required by NPS policy, a Value Analysis process was used to inform the selection of the preferred alternatives. The Value Analysis process identifies and ranks the relative advantages of each of the alternatives in meeting project-specific evaluation factors. When completed, the results show which alternative provides the greatest benefit to meet project goals and the NPS mission. Evaluators do not consider costs when evaluating advantages, but costs are compared to overall advantages to derive a cost-benefit ratio for each alternative. Costs are used to determine whether substantially added costs provide substantially added benefits. Under this method, a more costly alternative might be preferred if its substantially greater costs produced substantially greater benefits. Costs are also used in this method to refine alternatives to either increase benefits or reduce costs that do not produce benefits.

Separate Value Analysis evaluations were used to evaluate the preferred restoration alternative, the preferred public access alternative, and the preferred Pacific Way Bridge alternative. A neutral, experienced facilitator guided each of the three Value Analysis processes, with participants from NPS, SFZC, and Marin County. Each set of alternatives was evaluated for specific objectives within the categories of natural resource protection, cultural resource protection, public and worker health and safety, visitor enjoyment, operational efficiency,



Source: PWA 2004, NPS 2005

05052.05 EIR/EIS (rev.12-07)

Jones & Stokes

Figure ES-2
Preferred Restoration Alternative,
Preferred Parking Alternative, and Preferred Bridge Alternative

Exhibit 2: Final Environmental Impact Statement

and minimization of construction impacts. More details related to the Value Analysis can be found in Chapter 2.

Benefits of the Preferred Alternative

The combined benefits of the preferred alternatives selected for this project—Restoration Alternative 2, Public Access Alternative ~~B3~~B4, and Bridge Alternative ~~BR3~~BR4—will bring to life a long-term vision for restoring ecological integrity to the mouth of one of the San Francisco Bay Area's most treasured and natural watersheds. Redwood Creek flows from Mt. Tamalpais to the coast in a largely protected watershed, but it is at its most confined, dysfunctional, and fragmented condition at the project site. When this project is implemented, the dynamic interaction of natural processes will once again return to virtually the full landscape for the first time in almost 100 years. Modern anthropogenic influences on this scenic Marin County coastal lowland will not be fully erased, but the project will nevertheless enable the forces of a natural stream to retake their place as the centerpiece of the landscape.

The combined set of preferred alternatives will allow a natural and dynamic evolution of the creek, floodplain and wetland system; remove as many obstacles as reasonably possible to natural processes; minimize the need for maintenance; and reconcile conflicts with desirable human activities to the extent possible. Water, waves, and wind will create landforms, aquatic niches, and naturally sustained habitat without undue human interference or landscape relicts.

While benefits and impacts of the Restoration, Public Access, and Bridge Alternatives are analyzed separately in this Final EIS/EIR, the greatest benefits will occur due to the combination of these three project components. Each component addresses a particular obstruction to natural creek processes that have contributed to a downward trajectory in salmonid habitat quality and increased flooding. The combined benefit of creek realignment under Restoration Alternative 2, parking lot reconfiguration under Public Access Alternative ~~B3~~B4, and Bridge Alternative ~~BR3~~ BR4 will create the most unobstructed creek and floodplain in the project area since about the 1920s. All of the components function together to improve flow conveyance, sediment transport, floodplain function, and habitat value, while also improving vehicular access, and maintaining visitor and residential access. Sediment will be transported more effectively because the creek channel will be relocated to its natural topographic low point and will slope at a more natural gradient. Sediment transport will no longer be obstructed by an undersized Pacific Way Bridge or an undersized floodplain next to the lower end of the parking lot. With the preferred parking lot alternative, the floodplain next to the parking lot will expand from its current 50 feet of width to a minimum of ~~180~~ 350 feet wide, with an unobstructed floodplain on the opposite side of the creek as well.

The project will enhance the essential habitat qualities needed by the resident coho salmon and steelhead during winter and spring flow conditions. When the creek is reconnected with contiguous floodplain habitat throughout the entire 38-

acre project site, salmon using the floodplain habitat will no longer be obstructed from returning to the creek by a levee or a road. The floodplain will meet one of the most important winter-time needs of juvenile coho—a good feeding ground for fattening up before migrating to the ocean, thereby enhancing their chances of survival and return. New backwater habitat both upstream and downstream of Pacific Way, together with the expanded floodplain connection, will also provide steelhead and coho with areas where they can take refuge during the force of high velocity flows, a habitat quality that is currently deficient in Redwood Creek. With these improvements, the survival of young steelhead and coho over winter months is expected to improve.

The new, longer Pacific Way Bridge proposed as part of this project offers an ecological benefit that has rarely been used in typical road engineering. It will not only improve vehicular access during the winter, but will be long enough to span an additional 215~~115~~ feet of floodplain width, thereby retaining the important upstream-downstream floodplain connection for both fish habitat and natural creek meander. Whereas residents currently experience restricted road access under routine winter events, the new bridge and raised road will allow vehicular access in all but very large storm events, and even then, access will only be limited for a short duration. Although this project cannot prevent flooding in a natural floodplain, road access will be available even if there are long-term changes in flood elevations, because both the road and the bridge will be higher and constructed to allow for long-term channel changes. With good road access to residences during winter events, the current demand for creek dredging to reduce flooding will subside.

Visitors will experience multiple benefits of this project. They will have the opportunity to witness the restoration process, which takes on new meaning as public awareness of human interference with ecological functions grows. People seek out national parks across the United States to restore their personal sense of aliveness in places where nature unquestionably thrives. The project will allow the estimated 260,000~~440,000~~ annual visitors to the site to witness an ecosystem regaining its natural function. Even in the project's infancy after construction, when trees are immature and native wetland species have not yet colonized their likely niches, NPS expects that visitors will appreciate and enjoy the new integrity of the site as a whole, with the reconfigured parking lot acting as a less imposing central feature of the coastal landscape. Stewardship volunteers will reap a personalized enjoyment from their hands-on participation in revegetating native plant communities after construction. Visitor facilities will also be enhanced, with the parking lot blending more pleasantly with its surroundings through vegetated wetland swales, installation of new vault toilets, and, in particular, through a new trail along Pacific Way from Hwy 1 to the parking lot. The trail will meet Americans with Disabilities Act (ADA) standards, and it will provide pedestrians with an access route to the beach where conflicts with vehicles can be avoided. The new roadside trail will expand area trail connections by joining a new proposed trail alignment up Dias Ridge from the Golden Gate Dairy, making a trail available for the first time from Panoramic Highway to the beach. There is also a connection from the beach to the Coastal Trail.

The benefits of removing the channel confinements are expected to also enhance the natural range of fluctuation at the intermittent tidal lagoon on the north end of the beach. Creek flows will be able to scour the lagoon more effectively with the improved force of winter flows from an unobstructed upstream channel. The lagoon areal extent and depth will therefore have more natural variability. With added log structures, reminiscent of natural large woody debris washed downstream to the beach in the period before watershed development, coho and steelhead will have improved cover in the intermittent lagoon.

One of the least-seen beneficiaries of this project may be the California red-legged frog, a federally threatened species whose numbers at the site are so low that their very persistence there is in jeopardy. Because its current habitat is provided by the same features that obstruct creek processes and promote ponding, this project takes the long view toward providing a more hydrologically sustainable habitat for the frog. This project will remove the channel confinements, but will retain the cattail habitat at the south end of the Green Gulch pasture. It will also excavate new ponds that will be fed by groundwater and will support emergent vegetation where frogs lay their eggs. Should augmentation of the existing red-legged frog population be required, the improved habitat conditions should support any added frogs. With these changes and with an additional new breeding population on NPS lands at the Banducci Site (0.5 mile upstream) as part of separate actions, California red-legged frog populations within the Redwood Creek watershed will be sustainable for the long term.

The benefits of this project extend well below ground to the buried archaeological resources at the site. It is the mission of NPS to protect cultural resources, and this project will succeed in not only protecting them, but in learning more about the site's Coast Miwok history than had this project never been conducted. Coast Miwok who once lived in this region have left good evidence of their hunting and fishing activities at Muir Beach. As part of the project planning, NPS has conducted subsurface explorations to learn more about the dates and types of Coast Miwok use. New information about the Coast Miwok activities here will be used in a new cultural resources interpretation of the site that will add depth to the public understanding of earlier human use as well as earlier landscapes.

Beyond enhanced protection and interpretation of archaeological sites, the project will also help re-establish the connection of a living indigenous tribe, the Federated Indians of Graton Rancheria, with parts of our parklands. An ecological restoration that includes a cultural-ecological component derived from the traditions and land uses of indigenous people will create a visible and tangible fabric with deep interpretive potential to visitors and respect to the original occupants of these lands.

One asset of the project approach is that its benefits can be achieved without hauling hundreds or thousands of truckloads of excavated fill long distances down Hwy 1 and through the commercial area of Mill Valley. The project alternatives can be constructed with all fill either reused in the local watershed or

placed safely and sustainably in the Unused Reservoir Pit on NPS property, only about 2 miles north of the site.

Impacts and Mitigation Measures

A list of specific resource topics was developed to focus on and compare environmental impacts of the various alternatives. The list was drafted based on applicable laws, regulations and policies, as well as comments from park staff and the interested and affected public, including other agencies that were contacted during scoping. Chapter 3 of the Final EIS/EIR describes, for each resource topic, the existing environment that could be affected by the proposed actions. These existing conditions establish the baseline for the analysis of effects. Chapter 4 provides a detailed analysis and discussion of the probable environmental consequences, or impacts, of implementing the alternatives.

NPS management policies require analysis of whether an alternative might impair NPS values or resources. None of the alternatives considered in this document would impair park resources.

Tables ES-1a–ES-1d summarize the environmental impacts (including cumulative impacts) of the alternatives, the level of significance before mitigation, mitigation measures, and the level of significance after mitigation. Impacts are summarized for each alternative by resource topic. Impacts are classified as beneficial or adverse; and negligible, minor, moderate or major, as described below. These four designations apply to beneficial as well as adverse impacts.

- **Negligible**—The impact is at the lower level of detection; there would be no measurable change.
- **Minor**—The impact is slight but detectable; there would be a small change.
- **Moderate**—The impact is apparent and appreciable; there would be a noticeable change, but it may be short term or not permanent.
- **Major**—The impact is severe; there would be a highly noticeable, long-term, and/or permanent measurable change.

In addition to the designations given above, CEQA requires the determination of whether an adverse impact is considered significant. Significant adverse impacts are denoted in the table in **bold** type. For the purposes of CEQA, all adverse impacts that are characterized as major are considered significant and require mitigation. Moderate adverse impacts may be considered significant depending upon context, intensity, and duration. Impacts resulting from temporary construction-related activities and operational activities are indicated as such.

Significant Unavoidable Impacts

The alternatives evaluated would result in 29 significant unavoidable environmental impacts; of these, ~~13~~ 11 are construction-related impacts. The preferred alternative (Restoration Alternative 2, Public Access Alternative ~~B3~~B4, Bridge Alternative ~~BR3~~BR4, and fill disposal within the watershed) would result in only 9 of these significant unavoidable environmental impacts, of which all are construction related. The significant and unavoidable impacts of the preferred alternative are summarized below.

Preferred Alternative

- **VEG-R2: Construction-Related Impacts on Vegetation Communities.** During construction, disturbance to vegetation communities at the site would be unavoidable.
- **REC-R1: Reduced Recreational Opportunities and Visual and Noise Disturbance During Construction.** Although efforts would be made to reduce impacts of restoration construction on recreation, some impacts would be unavoidable.
- **REC-P1: Reduced Resident and Visitor Access, Visitor Amenities, and Recreational Opportunities During Construction.** Reductions in available parking and other site amenities during construction of the Public Access Alternatives would have significant effects.
- **AES-R1: Alteration of Scenic Views and Existing Visual Character During Construction Activities.** Construction activities would have unavoidable adverse effects on views and character at the site, which would cease once construction was complete.
- **AES-P1: Alteration of Scenic Views and Existing Visual Character During Construction Activities.** Construction activities would have unavoidable adverse effects on views and character at the site, which would cease once construction was complete.
- **AES-B1: Alteration of Scenic Views and Existing Visual Character During Construction Activities.** Construction activities would have unavoidable adverse effects on views and character at the site, which would cease once construction is complete.
- **TC-P1: Changes in Parking Availability During Construction.** Reductions in available parking during construction of the Public Access Alternatives would be considered significant from the standpoint of parking adequacy.
- **NZ-R1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Construction Activities.** Construction noise would be minimized to the extent possible but would still be considered a significant impact.

- **NZ-B2: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Pile Driving.** Despite the implementation of mitigation, the extreme level of noise generated by pile driving is considered a significant and unavoidable impact.

Cumulative Impacts

The Final EIS/EIR considered a list of 35~~34~~ projects that could potentially combine with the Big Lagoon project to create cumulative impacts. It also considered the projections associated with the Marin Countywide Plan and the traffic projections in the Comprehensive Transportation Management Plan for Parklands in Southwestern Marin (a now inactive effort). The majority of the projects considered are projects within the Redwood Creek watershed that involve sediment control, improved aquatic and upland habitat, invasive species removal, trail and roadway improvements, and flood reduction actions. As such, the majority of these projects have primarily beneficial impacts, and would combine with the Big Lagoon project to create cumulatively beneficial impacts.

Resource areas with cumulatively beneficial impacts included watershed processes (including hydrology, flooding, geology/soils/geohazards, and geomorphology), water quality (by helping to address existing water quality problems), vegetation communities and wetlands (by improving site function), wildlife and fisheries (including benefits to CRLF and listed salmonids), recreation, traffic, and aesthetics. Resource areas with no potential for contribution to cumulative effects include water supply, cultural resources, land use, agriculture, human health and safety, and noise.

No significant adverse cumulative impacts were identified. Less-than-significant cumulative impacts include construction-related effects on air quality, recreation, and public services and utilities.

For a detailed discussion of cumulative impacts, please refer to Chapter 5.

Growth Inducing Impacts

Implementation of the project would not induce major or significant development or economic growth in the vicinity. Construction of the project would not generate a substantial number of new jobs that could cause economic growth in the area. Public access improvements would be expected to benefit visitors to the area; however, the improvements would not be expected to substantially increase the number of visitors to the project area. Similarly, the project would improve year-round access for local residents from replacement of the Pacific Way Bridge, but would not stimulate development at Muir Beach, which is guided instead by the Marin County Local Coastal Plan, the Muir Beach Community Plan, the Marin Countywide Plan, and the Marin County Code, as well as decisions made by the County's Community Development Department and Board of Supervisors under the auspices of these plans and policies.

Significant Irreversible Environmental Changes

The restoration of the site is not considered an irreversible environmental change because the landscape could again be converted to other land uses in the future. The proposed project does not involve converting the land to urban land uses, which tend to be irreversible for all practical purposes. None of the impacts of the alternatives are expected to result in significant irreversible environmental changes.

Environmentally Preferable Alternative

NEPA requires identification of the environmentally preferable alternative. CEQA similarly requires identification of the environmentally superior alternative. For the purposes of this document, the term "environmentally preferable alternative" is used in place of "environmentally superior alternative."

The environmentally preferable alternative is the combination of Restoration Alternative 2, Public Access Alternative ~~B3~~ B4, Bridge Alternative BR4, and the Unused Reservoir. Each of the components of the environmentally preferred alternatives is discussed in more detail below.

Restoration Alternatives

Restoration Alternative 2 is considered the environmentally preferable Restoration Alternative. This is due to the fact that it achieves similar long-term benefits with respect to ecological value and visitor/resident experience; however, construction would have a smaller footprint, would be of shorter duration than either Restoration Alternatives 3 or 4, and would require less haulage of fill off-site. This would result in reduced impacts related to:

- the physical environment in terms of air quality (fewer construction-related dust and exhaust emissions);
- biological resources in terms of disturbance to on-site vegetation and wildlife communities;
- cultural resources in terms of potential disturbance of previously undiscovered cultural resources; and
- social resources in terms of reduced effects on recreation and visitor/resident experience during construction, including effects related to construction-related vehicle trips, aesthetics, and noise.

While this alternative would not reduce flooding to the same extent as the other alternatives, the benefits identified above related to construction are determined to outweigh this shortcoming.

Public Access Alternatives

Public Access Alternative B4 is considered the environmentally preferable Public Access Alternative. This is due to the fact that this alternative does not reduce visitor experience due to reduced parking lot capacity. In addition, it avoids the adverse effects to aesthetics and biological resources of the larger lot and the remote lot.

Bridge Alternatives

Bridge Alternative BR4 is considered the environmentally preferable Bridge Alternative. Construction-related effects are anticipated to be similar among all the Bridge Alternatives. However, Bridge Alternative BR4 would allow for the greatest level of all-weather access; this bridge would provide access during a very large magnitude event (i.e., much larger than a 10-year event and probably as close as possible to a 100-year event). Its ultimate capacity would be determined during project design, when other design constraints can be fully considered simultaneously by bridge engineers ~~by being entirely located above the 100-year flood elevation~~. Because Alternative BR4 would span the entire floodplain, it would allow for improved natural function at the site by allowing for channel migration and floodplain connectivity. Its long span would have marginally greater benefits for reducing upstream flooding during moderate events, but not during very large events.

Fill Disposal Alternatives

The Unused Reservoir Pit is considered the environmentally preferable Fill Disposal Alternative. This is because it would have a relatively short haul distance, would not involve extensive site upgrades to allow for fill disposal, and would restore an existing man-made feature to a more natural configuration. While other alternatives may have shorter haul distances (e.g., Upper Banducci Field), or provide for similar if not greater ecological benefits (Hamilton Wetlands Restoration), they do not offer the same combination of minimizing adverse impacts while maximizing beneficial impacts.

Plans and Plan Consistency

An evaluation of the alternatives' consistency with the Marin Countywide Plan and various other planning and policy documents is contained in Section 4.3.4.6, *Land Use, Planning and Agricultural Resources*, of this Final EIS/EIR and elsewhere in the document as appropriate. The determination of policy consistency discussed in this Final EIS/EIR represents the Final EIS/EIR authors' best judgment (in consultation with County staff) based on strict interpretation of policies. However, policy consistency must ultimately be determined by the Marin County Board of Supervisors and not in this Final EIS/EIR. The Board of

Supervisors may reach a different conclusion than the Draft EIS /EIR, as a result of its review of the entire record.

Note that the EIS/EIR evaluates consistency using a 2006 draft version of the Countywide Plan, since the plan had not been adopted at the time of Draft EIS/EIR circulation. While the adopted 2007 Countywide Plan has minor changes from the draft 2006 plan, these changes do not alter the conclusions of the impact analysis. The details of new or changed pertinent policies will be addressed in the staff report used for consideration of the merits of the project, and the Final EIS/EIR amendment will discuss the main relevant policies that have changed.

The Final EIS/EIR finds that the all of the Restoration, Public Access, Bridge, and Fill Disposal Alternatives presented in the Final EIS/EIR are consistent with relevant plans and policies of the County. All of the Restoration Alternatives involve reduction in the size of Green Gulch Field 7. This field is currently used to pasture horses, and its capacity would be reduced by one horse. Because this is a relatively small change, and it would not obstruct attainment of Countywide Plan policies, it was not considered inconsistent with the ~~following~~ policies~~. from the 1994 Countywide Plan.:~~

- ~~**EQ4.7b:** This policy encourages use of contracts to preserve and maintain portions of the open space corridor in their present dairying and ranching uses.~~
- ~~**CD-8.9:** This policy requires designations of land for agriculture and conservation where it has resource value for both agricultural production and for wetland and wildlife habitat.~~
- ~~**CD-15.1**: This policy requires that the County designate and maintain lands for agriculture at low densities in the Coastal Recreation Corridor.~~
- ~~**A-1.1:** This policy requires that agricultural lands be preserved by maintaining agricultural parcels in sizes large enough to sustain agricultural production, avoiding conversion of agricultural land to non-agricultural uses, discouraging uses that are not compatible with long-term agricultural productivity, and encouraging programs that assist agricultural operators and owners in maintaining the agricultural productivity of their land and marketing their products.~~
- ~~**A-1.5:** This policy requires the County to encourage the acquisition or dedication of perpetual agricultural conservation easements.~~
- ~~**A-1.9:** This policy requires the County to support the continued agricultural operations and agricultural land uses within the "pastoral zones" of the Golden Gate National Recreation Area.~~

~~Several of the Public Access Alternatives (B1, B2, and C) would reduce parking capacity at Muir Beach. The 1994 Countywide Plan contains Policy TR-3.5, which requires that parking needs be addressed at trailheads. Because the Muir Beach parking lot serves as a trailhead for the Coastal Trail and other regional trails, a reduction in parking capacity is inconsistent with this policy. However,~~

~~the preferred alternative (Public Access Alternative B3) would maintain existing parking lot capacity and would be consistent with the Marin Countywide Plan.~~

In summary, the preferred alternative is considered consistent with the Marin Countywide Plan.

Areas of Controversy

Between December 2002 and December 2004, 17 public meetings were held, as well as a variety of site visits and meetings with representatives of various agencies. In support of the release of the NOI, public scoping meetings were held on October 22, October 29, and November 2, 2002, with a site visit for the public held on November 9, 2002, to solicit input on the project and its potential impacts. Following these meetings, a Big Lagoon Working Group consisting of interested individuals, agencies, and organizations was formed to help develop project alternatives. The working group convened regularly in meetings that were open to the public. In addition, two alternatives workshops were held for the public on September 30 and October 4, 2003. Marin County circulated a Notice of Preparation of an Environmental Impact Report on April 27, 2004, soliciting comments on the specific issues to be included in the scope of CEQA environmental review.

Key issues of public concern regarding the project that were identified during the various meetings, workshops and the scoping process have included the following:

- Restoration approach and alternative design approach and assumptions
- Project sustainability and resiliency
- Project funding sources
- Project sponsors, inter-relationships and decision-making processes
- Effects of prior flood control actions
- Mitigation for the Caltrans repair on Hwy 1
- Existing conditions with respect to CRLF
- Comprehensive Transportation Management Plan and relationship to Big Lagoon Project
- Baseline conditions for Final EIS/EIR analysis
- Visitor use carrying capacity
- Water resources: flood protection; water rights and water supply; water quality and beneficial uses, including off-site inputs; streamside buffers
- Biological resources: invasive species; wetland impacts; listed species (CRLF, salmonids); cultural resources

- Social resources: Effects on Muir Beach residents; site character; equestrian operations and availability of facilities/opportunities.
- Potential impacts from truck traffic on Hwy 1 and in Mill Valley.

Of the public issues raised to date, several may be identified as controversial by certain parties. Some areas of controversy are not within the purview of NEPA and CEQA, because those statutes focus on evaluation of significant effects to the human and physical environment.

Issues to be Addressed or Resolved

The following issues need to be addressed or resolved prior to project implementation:

- **Pacific Way Bridge design.** At this time, the Pacific Way Bridge has only been conceptually described, although hydraulic models have provided specific analyses of its function. A specific construction design, and related plans and specification will need to be prepared for the bridge.
- **Final design of restoration and public access project components.** While conceptual designs have been better developed for the Restoration and Public Access Alternatives, a specific design, and related plans and specifications, will also need to be prepared for the restoration and public access features of the project.
- **Location of pedestrian boardwalk/bridge to beach.** As part of design of the public access component of the project, the pedestrian boardwalk and bridge will need to be sited. The impact analysis in the Final EIS/EIR covers a range of possible locations and establishes performance criteria for the new bridge.
- **Timing of Pacific Way Bridge construction.** The Final EIS/EIR includes, as part of the project, the possibility of delaying the construction of the Pacific Way Bridge until after completion of the larger restoration project downstream of the bridge. If the bridge construction is delayed, construction of the new channel upstream of Pacific Way would also be delayed. This scenario would entail constructing a temporary channel alignment from the existing bridge to the new channel alignment in the pasture. The timing of bridge construction will depend upon the timing/extent of funding for the bridge, as well as the design and decision-making process and contracting by Marin County.

Changes Between the Draft and Final EIS/EIR

The following changes were made between the Draft and Final EIS/EIR:

- The maximum width of the Bridge Alternatives has been reduced from 36 to 32 feet. This change applies to all Bridge Alternatives;

- Based on conceptual design conducted as part of this Final EIS/EIR, Bridge Alternative BR4 has been slightly reduced in length from 266–300 feet to 250 feet;
- The tavern retaining wall would be removed, but the chimney would not;
- The Preferred Bridge Alternative has been changed from BR3 to BR4. This change is based on an agreement that the longer bridge will provide better vehicular access and opportunity for natural hydrologic processes to reestablish. The longer bridge will also accommodate greater flows, minimizing potential backwater flows that could increase flood elevations upstream;
- The Preferred Public Access Alternative has been changed from B3 to B4 for its superior geophysical and ecological benefits related to improved flood protection and improved sediment transport to the beach and near-shore environment; and
- The lower 400 linear feet of the relocated channel in Green Gulch Pasture will have either discontinuous or no berms on the banks to allow floodplain connection during annual winter events.

These are considered minor technical changes that, pursuant to CEQA guidelines 15088.5, do not require recirculation of the Draft EIS/EIR prior to its certification.

Public Comments and Responses

The Final EIS/EIR includes all of the comments received on the Draft EIS/EIR, responses to those comments, and changes to the impact analysis as needed to respond to comments. NPS received 25 comment letters, including e-mails and response forms, on the Draft EIS/EIR. NPS also received comments from attendees at the public hearing held for the Draft EIS/EIR. A total of 155 individual comments were received on the Draft EIS/EIR.

Major issues raised in letters, e-mails, and public hearing comments were related to the preferred Bridge Alternative, the preferred Public Access Alternative, salmonid rearing habitat, sea level rise, and public transportation. Three Master Responses were developed to address comments relating to the preferred Bridge Alternative, salmonid rearing habitat, and sea level rise. Each comment is responded to individually as well.

Major Conclusions

1. With respect to the preferred alternative, the Final EIS/EIR evaluated a total of ~~216~~235 environmental impacts, of which ~~124~~125 are construction-related impacts. Of the total number of impacts, ~~36~~ 37 were identified as significant or potentially significant impacts, including ~~34~~35 construction-related

impacts. Feasible mitigation is available to reduce all but ~~11~~ nine of the project's significant effects to a less-than-significant level, ~~including 10~~all of which are construction-related impacts.

2. Project construction would have several construction-related significant and unavoidable impacts, including short-term adverse effects on vegetation communities and functions and values of water bodies, reduced visual character, reductions in parking capacity at Muir Beach, reduced resident and visitor access, visitor amenities, and recreational opportunities, and noise impacts, particularly due to potential pile driving for the new bridge on Pacific Way.
3. The project site would be returned to a more natural ecological and hydrologic function as a result of realignment of the creek channel and relocation of the parking lot at Muir Beach. The restoration design is considered to be more sustainable than the site's existing degraded condition.
4. The habitat at the site currently used by CRLF would not be removed by the proposed project; additional habitat would also be created. Additional CRLF habitat would also be provided upstream at the Banducci site.
5. Conditions for special-status salmonids (coho salmon and steelhead trout) would be improved at the site through provision of summer and winter rearing habitat. Fish passage conditions would be maintained or improved throughout the site.
6. The project would not have adverse effects on cultural resources at the site. No historic structures are located on the site (although Golden Gate Dairy is located adjacent to the site), and measures would be taken to avoid adverse effects on archaeological sites.
7. The project would substantially improve all-weather access on Pacific Way through relocation of the Redwood Creek channel, and construction of a higher bridge and raised roadway approach. Hydraulic modeling shows that under the preferred alternative, the bridge and associated roadway would remain passable during a very large magnitude event of greater than the 10-year and as close as possible to a 100-year storm event ~~at least the 10-year and smaller design storm events~~.
8. The project would reduce flooding in the project area overall through improved flood conveyance. Under the preferred alternative, all flows during the 1.5–2 year design storm event would be contained in the channel upstream of Pacific Way, providing relief from the frequent flooding that occurs under the existing conditions. Hydraulic modeling indicates that during the 5-year design storm event, flooding would be reduced by as much as 2 feet. During the 50-year and 100-year design storm events, flood elevations would be similar to existing conditions. By year 50, sea level rise and sediment deposition in the project area would make flooding conditions similar to existing conditions, but the new bridge would substantially improve vehicular access compared to existing conditions.
9. Interim flood control actions would have minor, short-term adverse effects related to work in the stream channel, but would provide minor flood

reduction benefits in the interim period while the restoration and bridge actions are completed.

10. The project would not diminish views of the project site or the landscape beyond the project site from off-site areas, such as the Muir Beach overlook or residences within the Muir Beach community. The new parking lot would be of improved aesthetic quality by adding vegetated swales in between parking rows, and would not protrude into the floodplain to the same extent as current conditions. The new bridge would be designed to be consistent with site character and be as unobtrusive as possible. The restoration would not substantially change scenic values of the site.
11. Parking capacity at Muir Beach would be maintained at current levels.
12. The new bridge would improve traffic safety and emergency access by providing for 2-way traffic. At present, the existing bridge is too narrow for 2-way traffic.
13. Pedestrian safety, ADA accessibility, and trail connections to other locations in the watershed would be improved by provision of a new trail from Hwy 1 to the Muir Beach parking lot. At present, most pedestrians compete with vehicles on Pacific Way. The new trail would be adjacent to Pacific Way.

Public Review Process

A Notice of Availability of the Final EIS/EIR has been published in the Federal Register, sent to the Governor's Office of Planning and Research, CEQA Clearinghouse, and posted at the Office of the County Clerk. Under CEQA guidelines the document is being made available for a 45-day public review and comment period. This period will begin on the date of the Environmental Protection Agency's notice of filing published in the Federal Register. At the completion of this process, a Record of Decision (ROD) will be issued by NPS that will specify all elements of the selected plan which will be implemented. Following confirmation of available funding, the Final EIS/EIR will be certified by Marin County and the County will make a determination regarding improvements to Pacific Way and the Pacific Way Bridge and issue a Notice of Determination (NOD) pursuant to CEQA.

Impact Summary Table ES-1a

Table ES-1a. *Restoration Alternatives*—Impact Summary

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
4.3.1.1 Watershed Processes					
WP-R1: Changes in Groundwater Levels	Negligible	Negligible	Negligible	Negligible	
WP-R2: Potential for Reduced Flows and Increased Frequency of Dry Periods in Redwood Creek	Minor Adverse	Minor Beneficial	Minor Adverse	Minor Adverse	
WP-R3: Temporary Dewatering Effects	Negligible	Negligible	Negligible	Negligible	
WP-R4: Reductions in Flood Elevations in the Near-Term	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	
WP-R5: Reductions in Flood Elevations Over the Long-Term	**Moderate Adverse** Annual flooding, risk of channel avulsion, and resulting risk to life and property would continue	Negligible	Minor Beneficial	Minor Beneficial	No Action Alternative: no mitigation available
WP-R6: Effects on Site Soils	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
WP-R7: Geohazards	Negligible	Negligible	Negligible	Negligible	
WP-R8: Ability to Accommodate Sediment Loads and Maintain Equilibrium Channel Form During Average Sediment Delivery Conditions	**Moderate Adverse** Existing conditions encourage channel aggradation	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	No Action Alternative: no mitigation available

Table ES-1a, *Restoration Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
WP-R9: Ability to Accommodate Sediment Loads and Maintain Equilibrium Channel Form During Episodic Events	**Moderate Adverse** Channel aggradation would increase the risk of channel avulsion and overbank flows	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	No Action Alternative: no mitigation available
WP-R10: Persistence of Backwater Features and Potential for Channel Avulsion	**Moderate Adverse** Aggradation and the risk of channel avulsion would increase over time	Moderate Beneficial	Moderate Beneficial	Major Beneficial	No Action Alternative: no mitigation available
WP-R11: Potential for Channel Incision	Negligible	Negligible	Negligible	Negligible	
WP-R12: Effects of Sediment Delivery on Nearshore Coastal Habitat, Beach Replenishment, and Dune Formation	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	
WP-R13: Effects on Tidal Lagoon Opening and Closure, and Overall Tidal Lagoon Function	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	
WP-R14: Effects of Sea Level Rise	See other impact discussions				
4.3.1.2 Water Quality Impacts					
WQ-R1: Release of Construction-Related Sediment from Access Roads, Staging Areas, Ground-Disturbing Activities and Stockpiles	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	WQ-MM-1: Obtain Coverage under General Construction Permit and Implement BMPs
WQ-R2: Release of Construction-Related Hazardous Materials	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	WQ-MM-2: Implement Spill Prevention and Control Plan
WQ-R3: Increased Turbidity in Redwood Creek Following Construction	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	WQ-MM-3: Implement Turbidity Monitoring and Response Plan
WQ-R4: Increased Nutrients in Redwood Creek Following Construction	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	WQ-MM-4: Implement Water Quality Monitoring and Response Plan

Table ES-1a, *Restoration Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
WQ-R5: Increased Water Temperatures in Redwood Creek Following Construction	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	WQ-MM-4
WQ-R6: Effects on Nutrients, Dissolved-Oxygen Levels, and Nuisance Plant Growth	Negligible	Minor Beneficial	Moderate Beneficial	Moderate Beneficial	
WQ-R7: Effects on Water Contact Recreation	Negligible	Negligible	Minor Beneficial	Minor Beneficial	
WQ-R8: Salinity Changes in Redwood Creek	Negligible	Negligible	Negligible	Negligible	
WQ-R9: Salinity Changes to groundwater	Negligible	Negligible	Negligible	Negligible	
WQ-R10: Potential for Nuisance Conditions Associated with Mosquito Breeding	Negligible	Moderate Beneficial	Minor Beneficial	Minor Beneficial	
4.3.1.3. Water Supply Impacts					
WS-R1: Potential Reductions in Groundwater Levels at the MBCSD Well near Redwood Creek	Negligible	Negligible	Negligible	Negligible	
WS-R2: Potential Reductions in Groundwater Levels at the Green Gulch Farm Well near Green Gulch Creek	Negligible	Negligible	Negligible	Negligible	
WS-R3: Potential Effects on SFZC Appropriative Water Right	Negligible	Negligible	Negligible	Negligible	
4.3.1.4 Air Quality Impacts					
AIR-R1: Generation of Construction-Related Pollutant Emissions	Negligible	Minor adverse	Minor adverse	**Moderate adverse** Construction activities would produce NOx emissions that would exceed thresholds	AIR-MM-1: Implement All Applicable BAAQMD Dust Control Measures. AIR-MM-2: Reduce NO_X Emissions from Off-Road Diesel-Powered Equipment.

Table ES-1a, *Restoration Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
4.3.2.1 Vegetation Communities and Wetlands Impacts					
VEG-R1: Construction-Related Impacts on Wetland Functioning	See Impacts WQ-R1 through WQ-R6.	See Impacts WQ-R1 through WQ-R6.	See Impacts WQ-R1 through WQ-R6.	See Impacts WQ-R1 through WQ-R6.	
VEG-R2: Construction-Related Impacts on Vegetation Communities	Minor Adverse	**Moderate Adverse** Disturbance to vegetation communities would be unavoidable during construction.	**Major Adverse** Disturbance to vegetation communities would occur over a longer duration and aeral extent.	**Major Adverse** Disturbance to vegetation communities would occur over a longer duration and aeral extent.	BMPs and avoidance/minimization will be implemented as part of action alternatives; residual impacts unavoidable.
VEG-R3: Increase in and Enhancement of Open Water Habitat	Negligible	Moderate Beneficial	Major Beneficial (Year 5); Moderate beneficial (Year 50)	Major Beneficial	
VEG-R4: Change in Extent and Quality of Emergent Wetland Habitat	Minor Adverse (Year 5); Minor Beneficial (Year 50)	Minor Adverse	**Moderate Adverse (Year 5)** /Minor Adverse (Year 50) Initial reduction in emergent wetland habitat is part of alternative design.	**Moderate Adverse** Reduced emergent wetland habitat is part of alternative design.	
VEG-R5: Change in Extent and Quality of Riparian Wetland Habitat	Minor Beneficial	Minor Adverse (Year 5); Major Beneficial (Year 50)	Minor Adverse (Year 5); Moderate Beneficial (Year 50)	**Moderate Adverse (Year 5)**; Minor Beneficial (Year 50) Reduction in riparian habitat is part of alternative design.	
VEG-R6: Increase in Dune Habitat	Negligible	Major Beneficial	Major Beneficial	Major Beneficial	
VEG-R7: Tree Removal	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
VEG-R8: Decreases in Noxious Weed Populations Due to Removal Activities	Negligible	Major Beneficial	Major Beneficial	Major Beneficial	
VEG-R9: Potential Increase in Noxious Weed Populations Due to Site Disturbance and Changed Groundwater Levels	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	

Table ES-1a, *Restoration Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
VEG-R10: Increased Lateral and Longitudinal Connectivity Among Channel, Floodplain, Riparian, and Upland Habitats	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	
VEG-R11: Changes in Areal Extent and Functions and Values of USACE-Jurisdictional Waters	Negligible	Minor Adverse (Year 0), Negligible (Year 5), Major Beneficial (Year 50)	Minor Adverse (Year 0), Negligible (Year 5), Major Beneficial (Year 50)	Minor Adverse (Year 0), Negligible (Year 5), Major Beneficial (Year 50)	
VEG-R12: Change in Habitat for Special-Status Plant Species	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	
4.3.2.2 Wildlife Impacts					
WLD-R1: Effects of the Short-Term Loss of Mature Riparian Habitat on Riparian-Associated and Cavity-Nesting Avian Species	Negligible	Negligible	Negligible	Negligible	WLD-MM-1: Preconstruction Surveys and Possible Installation of Nest Boxes
WLD-R2: Long-Term Effects of Riparian Enhancement on Riparian-Associated and Cavity-Nesting Species	Negligible	Moderate Beneficial	Minor Beneficial	Minor Beneficial	
WLD-R3: Construction-Related Disturbance to Nesting Birds	Negligible	Negligible	Negligible	Negligible	WLD-MM-2: Conduct Preconstruction Bird Surveys
WLD-R4: Operations And Maintenance Disturbance to Nesting Birds	Negligible	Negligible	Negligible	Negligible	
WLD-R5: Removal and/or Degradation of Emergent Wetland Habitat Used as Breeding, Foraging, and Roosting Habitat by Marsh Birds	Negligible	Moderate Adverse	Moderate Adverse (Year 5); Minor Adverse (Year 50)	Moderate Adverse	
WLD-R6: Effects on Waterfowl from Changes in Open Water Habitat	Negligible	Minor Beneficial	Minor Beneficial	Moderate Beneficial	

Table ES-1a, *Restoration Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
WLD-R7: Construction-Related Mortality of California Red-Legged Frogs (CRLF)	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	WLD-MM-3: Limit Construction Access Routes and Equipment Staging Areas and Conduct Preconstruction Surveys for CRLF in All Suitable Habitat That Will Be Disturbed by Construction
WLD-R8: Changes in Extent of CRLF Habitat	Minor Adverse	Minor Beneficial	Minor Beneficial	Minor Beneficial	WLD-MM-4: Augment CRLF Breeding Habitat WLD-MM-5: Implement Monitoring and Contingency Measures for CRLF WLD-MM-6: Reintroduce CRLF to Supplement Existing Population On Site
WLD-R9: Operations and Maintenance Effects on CRLF	Negligible	Negligible	Negligible	Negligible	
WLD-R10: Temporary Loss of CRLF Breeding Habitat During Construction	Negligible	Negligible	Negligible	Negligible	
WLD-R11: CRLF Habitat Fragmentation	Negligible	Moderate Beneficial	Minor Beneficial	Minor Beneficial	
WLD-R12: Increased Salinity Levels and Effects on CRLF	Negligible	Negligible	Minor Adverse	Minor Adverse	WLD-MM-7: Implement Measures to Protect CRLF from Temporary Saltwater Intrusion.
WLD-R13: Increased Predation on CRLF from Fish	Negligible	Minor Adverse	Minor Adverse	Moderate Adverse	All Alternatives: WLD-MM-5 Alternatives 3 and 4: WLD-MM-4: Augment CRLF Breeding Habitat
WLD-R14: Overall Effects on CRLF	Minor Adverse	Negligible	Minor Adverse	Minor Adverse	See above

Table ES-1a, *Restoration Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
WLD-R15: Effects on Special-Status Bird Species	Negligible	See Impacts WLD-R1 through WLD-R6	See Impacts WLD-R1 through WLD-R6	See Impacts WLD-R1 through WLD-R6	WLD-MM-1 WLD-MM-2
WLD-R16: Effects on Known Northern Spotted Owl Breeding Territories	Negligible	Negligible	Negligible	Negligible	
WLD-R17: Effects of Restoration on Transitional Monarch Butterfly Populations	Negligible	Negligible	Negligible	Negligible	
WLD-R18: Effects on Other Common Species of Wildlife	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
WLD-R19: Effects on Bats	Negligible	Negligible	Negligible	Negligible	WLD-MM-8: Implement Measures to Protect Bat Populations
4.3.2.3 Fisheries Impacts					
FISH-R1: Increased Turbidity in Redwood Creek During Construction	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Water Quality Mitigation Measures WQ-MM-1, WQ-MM-2, WQ-MM-3 and WQ-MM-4
FISH-R2: Accidental Release of Construction-Related Hazardous Materials	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Water Quality Mitigation Measure WQ-MM-2
FISH-R3: Increased Water Temperatures in Redwood Creek Following Construction	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	FISH-MM-1: Riparian Shade Mitigation and Monitoring
FISH-R4: Increase in Nutrients and Decrease in Dissolved Oxygen Levels Immediately Following Construction	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
FISH-R5: Increased Turbidity and Sedimentation in Redwood Creek Following Construction	Minor Adverse	Negligible	Negligible	Negligible	

Table ES-1a, *Restoration Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
FISH-R6: Fish Passage Barriers Due to Channel Design and Aggradation During the Project's Lifetime	**Moderate Adverse** The existing barriers to fish passage would persist and potentially worsen	Minor Beneficial	Minor Beneficial	Minor Beneficial	No Action alternative: no mitigation available
FISH-R7: Fish Entrapment Due to Out-of-Bank Flows and/or Channel Avulsion During the Project's Lifetime	**Major Adverse** The existing potential for fish entrapment would persist and potentially worsen	Minor Beneficial	Moderate Beneficial	Moderate Beneficial	No Action alternative: no mitigation available
FISH-R8: Effects on Summer-Fall Juvenile Salmonid-Rearing Habitat Immediately Following Construction	Minor Adverse	Minor Adverse	Minor Beneficial	Minor Beneficial	
FISH-R9: Effects on Summer-Fall Juvenile Salmonid-Rearing Habitat During Early Phases of Ecosystem Establishment	Minor Adverse	Minor Beneficial	Minor Beneficial	Moderate Beneficial	
FISH-R10: Effects on Juvenile Summer-Fall Salmonid–Rearing Habitat During Later Phases of Ecosystem Establishment	Minor Adverse	Negligible	Negligible	Moderate Beneficial	
FISH-R11: Effects on Juvenile Winter-Spring Salmonid– Rearing Habitat Immediately Following Construction	Minor Adverse	Minor Beneficial	Minor Beneficial	Minor Beneficial	FISH-MM-2: Optimizing of Winter Rearing Habitat
FISH-R12: Effects on Juvenile Winter-Spring Salmonid– Rearing Habitat During Early Phases of Ecosystem Establishment	Minor Adverse	Minor Beneficial	Moderate Beneficial	Moderate Beneficial	FISH-MM-2
FISH-R13: Effects on Juvenile Winter Salmonid– Rearing Habitat During Later Phases of Ecosystem Establishment	Minor Adverse	Minor Beneficial	Minor Beneficial	Minor Beneficial	FISH-MM-2

Table ES-1a, *Restoration Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
4.3.3 Cultural Resources Impacts					
CR-R1: Disturbance to Archaeological Site CA-MRN-333	Negligible	Negligible	Negligible	Negligible	CR-MM-1: Cultural Resources Education, Archaeological Monitoring, and Discovery Measures.
CR-R2: Disturbance to the "Fan Site"	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	CR-MM-1 CR-MM-2: Educate the Workers Conducting the Harding Grass Removal and Have an Archaeological Monitor in the Vicinity of the Fan Site.
CR-R3: Disturbance to CA-MRN-674	Negligible	Negligible	Negligible	Negligible	CR-MM-1
CR-R4: Disturbance to the Golden Gate Dairy	Negligible	Negligible	Negligible	Negligible	
CR-R5: Disturbance to Previously Unidentified Cultural Resources During Construction	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	CR-MM-1 CR-MM-2
CR-R6: Disturbance to Previously Identified or Unidentified Cultural Resources During Site Evolution	Negligible	Negligible	Negligible	Negligible	

Table ES-1a, *Restoration Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
4.3.4.1 Recreational and Visitor Experience Impacts					
REC-R1: Reduced Recreational Opportunities and Visual and Noise Disturbance During Construction	Negligible	**Moderate Adverse** Existing recreational opportunities would be reduced for three consecutive years.	**Moderate Adverse** Existing recreational opportunities would be reduced for four consecutive years.	**Moderate Adverse** Existing recreational opportunities would be reduced for four consecutive years.	NPS's public information outreach commitments would reduce this impact to the extent feasible. No additional mitigation has been identified as feasible and effective.
REC-R2: Visual and Noise Disturbance as a Result of Interim Flood Reduction Measures	Negligible	Negligible	Negligible	Negligible	
REC-R3: Altered Visitor Perception and Use of Site During Early Years of Site Recovery	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	
REC-R4: Effects of Restoration on Visitor Experience During the Life of the Project—Birding, Nature-Watching, and Other General Site Uses	Negligible	Major Beneficial	Major Beneficial	Major Beneficial	
REC-R5: Effects of Restoration on Visitor Experience During the Life of the Project—Equestrian Uses	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	
REC-R6: Effects on Visitor Profile and Number of Visitors to the Site	Negligible	Negligible	Negligible	Negligible	
REC-R7: Short-Term Effects on Visitor Safety During Restoration Construction	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	REC-MM-1: Construction Exclusion Areas REC-MM-2: Horse and Equestrian Safety Measures
REC-R8: Effects of Restoration Alternatives on Resident/Visitor Interaction	Negligible	Negligible	Negligible	Negligible	

Table ES-1a, *Restoration Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
4.3.4.2 Traffic					
TC-R1: Effects of Construction Mobilization and Materials Deliveries	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	TC-MM-1: Construction Traffic Management Plan
TC-R2: Effects of Construction Worker Trips to and from Site	Negligible	Negligible	Negligible	Negligible	
TC-R3: Effects of Construction Worker Parking	Negligible	Negligible	Negligible	Negligible	
TC-R4: Effects of Truck Trips Associated with Fill Disposal	Negligible	Minor Adverse	**Moderate Adverse** Small lagoon excavation would require a significant number of days for hauling.	**Moderate Adverse** Large lagoon excavation would require a significant number of days for hauling.	TC-MM-1
4.3.4.3 Aesthetics Impacts					
AES-R1: Alteration of Scenic Views and Existing Visual Character during Construction Activities	Minor Adverse	**Moderate Adverse** Construction activities would alter scenic views	**Moderate Adverse** Construction activities would alter scenic views	**Moderate Adverse** Construction activities would alter scenic views	Impacts unavoidable as part of alternative implementation
AES-R2: Decreased Visual Quality During Site Recovery and Plant Recolonization	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
AES-R3: Creation of New Visual Features on the Site	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	
AES-R4: Changes in the Broader Viewshed from Hwy 1 and Other Distant Vantage Points	Negligible	Minor Beneficial	Moderate Beneficial	Moderate Beneficial	
AES-R5: Replacement of Nonnative Vegetation with Native Plant Communities	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	
4.3.4.4 Energy, Public Services, Utilities, and Service Systems Impacts					
PS-R1: Increased Demand for Existing Energy Sources or Conflict with Adopted Policies or Standards for Energy Use	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	

Table ES-1a, *Restoration Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
PS-R2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner	Negligible	Negligible	Negligible	Negligible	PS-MM-1: Employ Sustainable Building Practices
PS-R3: Increased Demand for or Conflicts with Fire or Police Protection, Public Facilities Maintenance, or Other Governmental Services	Negligible	Negligible	Negligible	Negligible	
PS-R4: Increased Demand for or Conflict with Utility Lines or Service Systems	Negligible	Negligible	Negligible	Negligible	PS-MM-2: Maintain Utility Services
PS-R5: Increased Solid Waste Demands	Negligible	Negligible	Negligible	Negligible	PS-MM-1
4.3.4.5 Human Health and Safety Impacts					
HS-R1: Risk of Accidental Explosion or Release of Hazardous Substances During Construction	Minor Adverse	Negligible	Negligible	Negligible	WQ-MM-2: Implement Spill Prevention and Control Plan
HS-R2: Risk of Exposure to Hazardous Substances During Project Operations	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
HS-R3: Creation of Mosquito Breeding Habitat	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	
HS-R4: Exposure of People to Undiscovered or Undocumented Sources of Contamination	Negligible	Negligible	Negligible	Negligible	HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/Remediation
HS-R5: Increased Fire Hazard in Areas with Flammable Brush, Grass, or Trees	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	

Table ES-1a, *Restoration Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
4.3.4.6 Land Use, Planning, and Agricultural Resources Impacts					
LU-R1: Conversion of Agricultural Land to Non-Agricultural Use.	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
LU-R2: Consistency with Land Use Policies Related to Agriculture	Negligible	Negligible	Negligible	Negligible	
4.3.4.7 Noise Impacts					
NZ-R1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Construction Activities	Negligible	**Moderate Adverse** Construction noise would adversely impact residents, visitors, and wildlife	**Moderate Adverse** Construction noise would adversely impact residents, visitors, and wildlife	**Moderate Adverse** Construction noise would adversely impact residents, visitors, and wildlife	NZ-MM-1: Employ Noise-Reducing Construction Practices NZ-MM-2: Prepare a Noise Control Plan NZ-MM-3: Disseminate Essential Information to Residences and Implement a Complaint/Response Tracking Program
NZ-R2: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise During the Lifetime of the Restoration	Minor Adverse	Negligible	Negligible	Negligible	

Exhibit 2: Final Environmental Impact Statement

Impact Summary Table ES-1b

Table ES-1b. *Public Access Alternatives*—Impact Summary

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
4.3.1.1 Watershed Processes								
WP-P1 Alteration of Flood Elevations from Parking Lot and Picnic Area Configuration/Location	Negligible	Minor Beneficial	Negligible	Minor Beneficial	Minor Beneficial	Minor Adverse	Minor Beneficial	
WP-P2: Effects on Site Soils	Negligible	Negligible	Negligible	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
WP-P3: Geohazards	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
WP-P4: Alteration of Stream Channel Function and Geomorphic Evolution as a Result of Parking Lot Configuration	Negligible	Moderate Beneficial	Minor Beneficial	Minor Beneficial	Moderate Beneficial	Minor Beneficial	Moderate Beneficial	
4.3.1.2 Water Quality Impacts								
WQ-P1: Release of Construction-Related Sediment From Construction of Public Access Features	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	WQ-MM-1: Obtain Coverage Under General Construction Permit and Implement BMPs
WQ-P2: Release of Construction-Related Hazardous Materials	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	WQ-MM-2: Implement Spill Prevention and Control Plan
WQ-P3: Non-Point Source Runoff from Public Access Features	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	

Table ES-1b, *Public Access Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
4.3.1.3. Water Supply Impacts								
None								
4.3.1.4 Air Quality Impacts								
AIR-P1: Generation of Construction-Related Pollutant Emissions	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	AIR-MM-1: Implement All Applicable BAAQMD Dust Control Measures. AIR-MM-2: Reduce NO_X Emissions from Off-Road Diesel-Powered Equipment.
4.3.2.1 Vegetation Communities and Wetlands Impacts								
VEG-P1: Construction-Related Impacts on Wetland Functioning	See Impacts WQ-P1 and WQ-P2.	See Impacts WQ-P1 and WQ-P2.	See Impacts WQ-P1 and WQ-P2.	See Impacts WQ-P1 and WQ-P2.	See Impacts WQ-P1 and WQ-P2.	See Impacts WQ-P1 and WQ-P2.	See Impacts WQ-P1 and WQ-P2.	
VEG-P2: Construction-Related Impacts on Vegetation Communities	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
VEG-P3: Change in Extent and Quality of Riparian Habitat	Negligible	Moderate Beneficial	Minor Beneficial	Minor Adverse (Year 5); Negligible (Year 50).	Moderate Adverse (Year 5); Negligible (Year 50).	Minor Adverse	Negligible	
VEG-P4: Impacts on the Quality of Riparian and Wetland Habitat from Visitor Use	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	Negligible	Minor Adverse	Minor Adverse	
VEG-P5: Increase in Area of Wetland Swales	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	
VEG-P6: Tree Removal	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	

Table ES-1b, *Public Access Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
VEG-P7: Increase in Noxious Weed Populations from Visitors	Negligible	Minor Beneficial	Minor Beneficial	Negligible	Negligible	Minor Adverse	Minor Beneficial	
VEG-P8: Changes in Areal Extent and Functions and Values of USACE-Jurisdictional Waters	Negligible	Minor Beneficial	Minor Beneficial	Minor Adverse	Minor Adverse	Moderate Adverse	Minor Adverse	
VEG-P9: Change in Habitat for Special-Status Plant Species	Negligible	See Impact VEG-P3.	See Impact VEG-P3.	See Impact VEG-P3.	See Impact VEG-P3.	See Impact VEG-P3.	See Impact VEG-P3.	
4.3.2.2 Wildlife Impacts								
WLD-P1: Construction-Related Disturbance to Nesting Birds, Including Special Status Species	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	WLD-MM-2: Conduct Preconstruction Bird Surveys when necessary
WLD-P2: Changes in Mature Riparian Habitat for Riparian-Associated And Cavity-Nesting Birds, Including Special Status Species	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	WLD-MM-1: Preconstruction Surveys and Possible Installation of Nest Boxes
WLD-P3: Changes in Monarch Butterfly Overwintering Habitat	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
WLD-P4: Effects on Songbird Nesting Success Due to an Increase in Corvid Populations Facilitated by a Change in Public Access	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	WLD-MM-9: Implement Measures to Prevent Increases in Corvid Populations
WLD-P5: Effects on Bats	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	WLD-MM-8: Implement Measures to Protect Bat Populations
4.3.2.3 Fisheries Impacts								
None								

Table ES-1b, *Public Access Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
4.3.3 Cultural Resources Impacts								
CR-P1: Disturbance to Archaeological Site CA-MRN-333	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
CR-P2: Disturbance to the "Fan Site"	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	CR-MM-1: Cultural Resources Education, Archaeological Monitoring, and Discovery Measures.
CR-P3: Disturbance to CA-MRN-674	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	CR-MM-1 CR-MM-3: Limit Compaction Methods Above the Recorded Deposit; Consult with NPS, the County, and FIGR; and Clarify Site Disposition During the Design Process.
CR-P4: Disturbance to Golden Gate Dairy Complex	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
CR-P5: Disturbance to Previously Unidentified Cultural Resources During Construction	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	CR-MM-1
CR-P6: Disturbance to Previously Identified or Unidentified Cultural Resources During Site Evolution	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	

Table ES-1b, *Public Access Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
4.3.4.1 Recreational and Visitor Experience Impacts								
REC-P1: Reduced Resident and Visitor Access, Visitor Amenities, and Recreational Opportunities During Construction	Negligible	**Moderate Adverse** Construction activities would discourage visitors from using Muir Beach	**Moderate Adverse** Construction activities would discourage visitors from using Muir Beach	**Moderate Adverse** Construction activities would discourage visitors from using Muir Beach	**Moderate Adverse** Construction activities would discourage visitors from using Muir Beach	**Moderate Adverse** Construction activities would discourage visitors from using Muir Beach	**Moderate Adverse** Construction activities would discourage visitors from using Muir Beach	No feasible mitigation identified.
REC-P2: Effects of Parking Lot Configuration and Siting on Recreational Opportunities and Visitor Experience	Negligible	**Major Adverse** Parking availability would be substantially reduced during all seasons, except off-season weekdays	Minor Adverse	Negligible	Minor Beneficial	Minor Beneficial	**Moderate Adverse** Parking availability would be reduced during the peak season and on shoulder and off-season weekends	No feasible mitigation identified.
REC-P3: Effects of Visitor Amenities on Recreational Opportunities and Visitor Experience	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	
REC-P4: Short-Term Effects on Visitor Safety During Public Access Construction	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	REC-MM-1: Construction Exclusion Areas REC-MM-2: Horse and Equestrian Safety Measures

Table ES-1b, *Public Access Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
REC-P5: Effects of Parking Lot Configuration and Siting on Community Relationships	Negligible	**Major Adverse** Visitors would seek alternative parking opportunities in the Muir Beach community, Pelican Inn, or along Pacific Way	**Moderate Adverse** Visitors would seek alternative parking opportunities in the Muir Beach community, Pelican Inn, or along Pacific Way	Negligible	Minor Beneficial	Moderate Beneficial	Minor Beneficial	No feasible mitigation has been identified.
4.3.4.2 Traffic								
TC-P1: Changes in Parking Availability During Construction	Negligible	**Moderate Adverse** Parking would be reduced or unavailable at times during construction.	**Moderate Adverse** Parking would be reduced or unavailable at times during construction.	**Moderate Adverse** Parking would be reduced or unavailable at times during construction.	**Moderate Adverse** Parking would be reduced or unavailable at times during construction.	**Moderate Adverse** Parking would be reduced or unavailable at times during construction.	**Moderate Adverse** Parking would be reduced or unavailable at times during construction.	TC-MM-1: Construction Traffic Management Plan
TC-P2: Effects of Construction Mobilization and Materials Deliveries	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	TC-MM-1
TC-P3: Effects of Construction Worker Trips to and from Site	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
TC-P4: Effects of Construction Worker Parking	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
TC-P5: Effects of Truck Trips Associated with Fill Disposal	Negligible	Minor Adverse	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	TC-MM-1

Table ES-1b, *Public Access Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
TC-P6: Long-Term Changes in Parking Availability	Negligible	**Major Adverse** Parking capacity would be inadequate for demands during peak and shoulder seasons.	Minor Adverse	Negligible	Negligible	Minor Beneficial	**Moderate Adverse** Parking capacity would be inadequate for demands during the peak season and on shoulder and off-peak season weekends.	No feasible mitigation has been identified
TC-P7: Effects of Parking Lot Size on Vehicle Queuing	Negligible	**Major Adverse** Vehicular queuing would occur in all seasons except off-peak season weekdays.	Minor Adverse	Negligible	Minor Beneficial	Negligible	**Moderate Adverse** Vehicular queuing would occur during the peak season and on shoulder and off-season weekends.	No feasible mitigation has been identified
TC-P8: Effects of Parking Lot Size on LOS and Intersection Delay	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Negligible	Minor Adverse	

Table ES-1b, *Public Access Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
TC-P9: Long-Term Effects on Pedestrian, Equestrian, and Bicyclist Safety	Negligible	Minor Adverse	Minor Adverse	Minor Beneficial	Minor Beneficial	Moderate Beneficial	**Moderate Adverse** Safety hazards on Hwy 1 would arise when vehicles queue in the area.	No feasible mitigation has been identified
TC-P10: Long-Term Changes in Elderly and Disabled Accessibility	Negligible	Negligible	Negligible	Negligible	Minor Adverse	Negligible	Negligible	
TC-P11: Long-Term Effects on Emergency Access to Site	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
TC-P12: Consistency with NPS Policies Related to Parking	Negligible	Major Adverse	**Moderate Adverse** Parking capacity would be reduced during some seasons	Negligible	Negligible	Negligible	**Moderate Adverse** Parking capacity would be reduced during some seasons	
4.3.4.3 Aesthetics Impacts								
AES-P1: Alteration of Scenic Views and Existing Visual Character During Construction Activities	Negligible	**Moderate Adverse** Visitors and residents would have temporarily altered views during construction	**Moderate Adverse** Visitors and residents would have temporarily altered views during construction	**Moderate Adverse** Visitors and residents would have temporarily altered views during construction	**Moderate Adverse** Visitors and residents would have temporarily altered views during construction	**Moderate Adverse** Visitors and residents would have temporarily altered views during construction	**Moderate Adverse** Visitors and residents would have temporarily altered views during construction	Impacts are unavoidable as part of project construction

Table ES-1b, *Public Access Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
AES-P2: Creation of New Visual Features at Parking Lot Site and Change in Views from Hwy 1 and Other Distant Scenic Vantage Points	Negligible	Moderate Beneficial	Minor Beneficial	Negligible	Minor Beneficial	Minor Adverse	Minor Adverse	
AES-P3: Maintenance of Rustic Character of the Site	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	
AES-P4: Change in Light and Glare	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor Adverse	
4.3.4.4 Energy, Public Services, Utilities, and Service Systems Impacts								
PS-P1: Increased Demand for Existing Energy Sources or Conflict with Adopted Policies or Standards for Energy Use	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
PS-P2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	PS-MM-1: Employ Sustainable Construction Practices
PS-P3: Conflict with Emergency Response	Negligible	Moderate Adverse	Minor Adverse	Negligible	Negligible	Minor Beneficial	Minor Adverse	Emergency response would be similar to existing conditions. No mitigation is necessary.
PS-P4: Increased Solid Waste Demands	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	PS-MM-1
4.3.4.5 Human Health and Safety Impacts								
HS-P1: Risk of Accidental Explosion or Release of Hazardous Substances During Construction	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	WQ-MM-2: Implement Spill Prevention and Control Plan
HS-P2: Exposure of People to Undiscovered or Undocumented Sources of Contamination	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/Remediation

Table ES-1b, *Public Access Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
HS-P3: Increased Fire Hazard in Areas with Flammable Brush, Grass, or Trees	Negligible	Minor Beneficial	Minor Beneficial	Negligible	Minor Beneficial	Minor Adverse	Minor Adverse	
4.3.4.6 Land Use, Planning, and Agricultural Resources Impacts								
LU-P1: Consistency with Land Use Policies Related to Trails	Negligible	**Moderate Adverse** Parking availability for trail use would be reduced	**Moderate Adverse** Parking availability for trail use would be reduced	Negligible	Negligible	Negligible	**Moderate Adverse** Parking availability for trail use would be reduced	No mitigation available.
4.3.4.7 Noise Impacts								
NZ-P1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Parking Lot Construction	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	NZ-MM-1: Employ Noise-Reducing Construction Practices NZ-MM-2: Prepare a Noise Control Plan NZ-MM-3: Disseminate Essential Information to Residences and Implement a Complaint/Response Tracking Program
NZ-P2: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Use of the Parking Lot	Negligible	Minor Beneficial	Minor Beneficial	Negligible	Negligible	Minor Adverse	Minor Beneficial	
NZ-P3: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Roadway Noise	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	

Impact Summary Table ES-1c

Table ES-1c. *Bridge Alternatives*—Impact Summary

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact					Mitigation Measure
	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	
4.3.1.1 Watershed Processes—Restoration Alternative Impacts						
WP-B1: Effects of Bridge Configuration on Flooding	Negligible	**Moderate Adverse** Alternative would impede flood flows	Moderate Beneficial	Minor Beneficial	Moderate Beneficial	BR1: No mitigation available
WP-B2: Geohazards	Negligible	Negligible	Negligible	Negligible	Negligible	
WP-B3: Alteration of Stream Channel Function and Geomorphic Evolution as a Result of Bridge Configuration	Negligible	Minor Beneficial	Negligible	Moderate Beneficial	Major Beneficial	
4.3.1.2 Water Quality Impacts						
WQ-B1: Release of Construction-Related Sediment from Construction of Bridge Alternatives	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	WQ-MM-1: Obtain Coverage Under General Construction Permit and Implement BMPs
WQ-B2: Release of Construction-Related Hazardous Materials	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	WQ-MM-2: Implement Spill Prevention and Control Plan
4.3.1.3. Water Supply Impacts						
None						
4.3.1.4 Air Quality Impacts						
AIR-B1: Generation of Construction-Related Pollutant Emissions	Negligible	Negligible	Negligible	Negligible	Negligible	AIR-MM-1: Implement All Applicable BAAQMD Dust Control Measures. AIR-MM-2: Reduce NO_X Emissions from Off-Road Diesel-Powered Equipment.

Table ES-1c, *Bridge Alternatives,* Continued

4.3.2.1 Vegetation Communities and Wetlands Impacts						
VEG-B1: Construction-Related Impacts on Wetland Functioning	See Impacts WQ-F1 and WQ-F2.	See Impacts WQ-F1 and WQ-F2.	See Impacts WQ-F1 and WQ-F2.	See Impacts WQ-F1 and WQ-F2.	See Impacts WQ-F1 and WQ-F2.	
VEG-B2: Construction-Related Impacts on Vegetation Communities	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
VEG-B3: Change in Extent and Quality of Riparian Habitat	Negligible	Negligible	Minor Beneficial	Moderate Beneficial	Major Beneficial	
VEG-B4: Tree Removal	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
VEG-B5: Changes in Areal Extent and Functions and Values of USACE-Jurisdictional Waters	Negligible	Negligible	Minor Beneficial	Moderate Beneficial	Major Beneficial	
VEG-B6: Change in Habitat for Special-Status Plant Species	Negligible	See Impact VEG-B3.	See Impact VEG-B3.	See Impact VEG-B3.	See Impact VEG-B3.	
4.3.2.2 Wildlife Impacts						
WLD-B1: Construction-Related Disturbance to Nesting Birds	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	WLD-MM-2: Conduct Preconstruction Bird Surveys When Necessary
WLD-B2: Changes in Monarch Butterfly Habitat	Negligible	Negligible	Negligible	Negligible	Negligible	
WLD-B3: Effects on Bats	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	WLD-MM-8: Implement Measures to Protect Bat Populations
4.3.2.3 Fisheries Impacts						
FISH-B1: Fish Passage Impediments Due to Flow Alterations Resulting from Pacific Way Bridge During the Project's Lifetime	Negligible	Minor Adverse	Minor Adverse	Minor Beneficial	Minor Beneficial	
FISH-B2: Direct or Indirect Mortality and Increased Stress to Fish Due to Pile Driving and Increased Sound Pressure Levels	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	FISH-MM-3: Avoidance and Monitoring of High Sound Pressure Levels during Pile Driving Activities

Table ES-1c, *Bridge Alternatives,* Continued

4.3.3 Cultural Resources Impacts						
CR-B1: Disturbance to CA-MRN-674	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	CR-MM-3: Limit Compaction Methods Above the Recorded Deposit; Consult with NPS, the County, and FIGR; and Clarify Site Disposition During the Design Process.
CR-B2: Disturbance to Previously Unidentified Cultural Resources During Construction	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	CR-MM-1: Cultural Resources Education, Archaeological Monitoring, and Discovery Measures.
CR-B3: Disturbance to Previously Identified or Unidentified Cultural Resources During Site Evolution	Negligible	Negligible	Negligible	Negligible	Negligible	
4.3.4.1 Recreational and Visitor Experience Impacts						
REC-B1: Effects on Visitor Experience from the Bridge Alternatives	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	
4.3.4.2 Traffic						
TC-B1: Effects of Construction Mobilization and Materials Deliveries	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	TC-MM-1: Construction Traffic Management Plan
TC-B2: Effects of Construction Worker Trips to and from Site	Negligible	Negligible	Negligible	Negligible	Negligible	
TC-B3: Effects of Construction Worker Parking	Negligible	Negligible	Negligible	Negligible	Negligible	
TC-B4: Effects of Truck Trips Associated with Fill Hauling	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	TC-MM-1
TC-B5: Effects on Access and Safety on Pacific Way During Bridge Construction	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	TC-MM-1
TC-B6: Improvements to Circulation from New Bridge	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	

Table ES-1c, *Bridge Alternatives,* Continued

4.3.4.3 Aesthetics Impacts						
AES-B1: Alteration of Scenic Views and Existing Visual Character During Construction Activities	Negligible	**Moderate Adverse** Visitors and residents would have temporarily altered views during construction	**Moderate Adverse** Visitors and residents would have temporarily altered views during construction	**Moderate Adverse** Visitors and residents would have temporarily altered views during construction	**Moderate Adverse** Visitors and residents would have temporarily altered views during construction	Impacts unavoidable as part of alternative implementation
AES-B2: Creation of New Visual Features on the Site	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Moderate Adverse	
AES-B3 Change in Light and Glare	Negligible	Negligible	Negligible	Negligible	Negligible	
4.3.4.4 Energy, Public Services, Utilities, and Service Systems Impacts						
PS-B1: Increased Demand for Existing Energy Sources or Conflict with Adopted Policies or Standards for Energy Use	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
PS-B2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner	Negligible	Negligible	Negligible	Negligible	Negligible	PS-MM-1: Employ Sustainable Construction Practices
PS-B3: Conflict with Emergency Response During Project Construction	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
PS-B4: Conflict with Emergency Response Throughout the Lifetime of the Project	**Moderate Adverse** Reduced access during flooding events and parking constraints reduce emergency access and response time	Moderate Beneficial	Minor Beneficial	Moderate Beneficial	Major Beneficial	BR0: No mitigation available
PS-B5: Increased Demand for or Conflict with Utility Lines or Service Systems	Negligible	Negligible	Negligible	Negligible	Negligible	PS-MM-2: Maintain Utility Services
PS-B6: Increased Solid Waste Demands	Negligible	Negligible	Negligible	Negligible	Negligible	PS-MM-1

Table ES-1c, *Bridge Alternatives,* Continued

4.3.4.5 Human Health and Safety Impacts						
HS-B1: Risk of Accidental Explosion or Release of Hazardous Substances During Construction	Negligible	Negligible	Negligible	Negligible	Negligible	WQ-MM-2: Implement Spill Prevention and Control Plan
HS-B2: Exposure of People to Undiscovered or Undocumented Sources of Contamination	Negligible	Negligible	Negligible	Negligible	Negligible	HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/ Remediation
4.3.4.6 Land Use, Planning, and Agricultural Resources Impacts						
None						
4.3.4.7 Noise Impacts						
NZ-B1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Typical Construction Activities	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	NZ-MM-1: Employ Noise-Reducing Construction Practices NZ-MM-2: Prepare a Noise Control Plan NZ-MM-3: Disseminate Essential Information to Residences and Implement a Complaint/Response Tracking Program
NZ-B2: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Pile Driving	Negligible	**Moderate Adverse** Residents, visitors, and wildlife would experience adverse noise levels during construction	**Moderate Adverse** Residents, visitors, and wildlife would experience adverse noise levels during construction	**Moderate Adverse** Residents, visitors, and wildlife would experience adverse noise levels during construction	**Moderate Adverse** Residents, visitors, and wildlife would experience adverse noise levels during construction	NZ-MM-1 NZ-MM-2 NZ-MM-3
NZ-B3: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise During Operation of the Bridge	Negligible	Negligible	Negligible	Negligible	Negligible	

Exhibit 2: Final Environmental Impact Statement

Impact Summary Table ES-1d

Table ES-1d. *Fill Disposal Alternatives*—Impact Summary

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact					Mitigation Measure
	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail*	
4.3.1.1 Watershed Processes Impacts						
None						
4.3.1.2 Water Quality Impacts						
WQ-F1: Release of Construction-Related Sediment During Fill Disposal Activities	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	WQ-MM-1: Obtain Coverage Under General Construction Permit and Implement BMPs
WQ-F2: Release of Construction-Related Hazardous Materials During Fill Disposal Activities	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	WQ-MM-2: Implement Spill Prevention and Control Plan
4.3.1.3. Water Supply Impacts						
None						
4.3.1.4 Air Quality Impacts						
AIR-F1: Generation of Construction-Related Pollutant Emissions	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	AIR-MM-1: Implement All Applicable BAAQMD Dust Control Measures. AIR-MM-2: Reduce NO_X Emissions from Off-Road Diesel-Powered Equipment. AIR-MM-3: Limit the Daily Number of Fill Disposal Trips

Table ES-1d, *Fill Disposal Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact					Mitigation Measure
	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail*	
4.3.2.1 Vegetation Communities and Wetlands Impacts						
VEG-F1: Construction-Related Impacts on Vegetation Communities	Minor Adverse	Negligible	NA	NA	Minor Adverse	VEG-MM-1: Conduct Follow-Up Weed Control and Revegetation Activities to Establish Appropriate Native Plant Species
VEG-F2: Increase in Noxious Weed Populations	Minor Adverse	Minor Adverse	NA	NA	Minor Adverse	VEG-MM-1
VEG-F3: Change in Habitat for Special-Status Plant Species	Negligible	Negligible	NA	NA	Minor Adverse	
VEG-F4: Changes in Areal Extent and Functions and Values of Wetlands	Negligible	Negligible	NA	NA	Minor Beneficial	
4.3.2.2 Wildlife Impacts						
WLD-F1: Construction-Related Disturbance to Nesting Birds	Minor Adverse	Minor Adverse	NA	NA	Minor Adverse	WLD-MM-2 when necessary
4.3.2.3 Fisheries Impacts						
None						
4.3.3 Cultural Resources Impacts						
CR-F1: Disturbance to Previously Unidentified Cultural Resources During Construction	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	CR-MM-1: Cultural Resources Education, Archaeological Monitoring, and Discovery Measures.
CR-F2: Disturbance to Previously Unidentified Cultural Resources During Site Evolution	Negligible	Negligible	Negligible	Negligible	Negligible	
CR-F3: Disturbance to the "Fan Site"	Negligible	Negligible	Negligible	Negligible	Minor Adverse	CR-MM-1 CR-MM-4: Fence Off the Fan Site Fill Hauling So That Trucks Cannot Inadvertently Damage the Site

Table ES-1d, *Fill Disposal Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact					Mitigation Measure
	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail*	
4.3.4.1 Recreational and Visitor Experience Impacts						
REC-F1: Changes in Visitor Experience from Truck Trips and Fill Disposal Activities	Negligible	Negligible	Negligible	Negligible	Negligible	
REC-F2: Changes in Visitor Experience from Altered Fill Disposal Site Characteristics	Moderate Beneficial	Negligible	Moderate Beneficial	Negligible	Negligible	
4.3.4.2 Traffic						
TC-F1: Effects of Fill Disposal Site Preparation	Minor Adverse	Minor Adverse	Negligible	Minor Adverse	Minor Adverse	TC-MM-1: Construction Traffic Management Plan
TC-F2: Effects of Truck Trips Associated with Fill Hauling	Minor Adverse	Minor Adverse	**Major Adverse** The amount of truck trips required for hauling and additional traffic constraints would be significant.	Minor Adverse	Minor Adverse	TC-MM-1
4.3.4.3 Aesthetics Impacts						
AES-F1: Alteration of Scenic Views and Existing Visual Character During Hauling Trips and Fill Disposal Activities	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
AES-F2: Creation of New Visual Features on the Site	Moderate Beneficial	Negligible	NA	Minor Beneficial	Minor Beneficial	

Table ES-1d, *Fill Disposal Alternatives*, Continued

Impact	Impact Level (after Mitigation) **Bold** denotes a significant adverse impact					Mitigation Measure
	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail*	
4.3.4.4 Energy, Public Services, Utilities, and Service Systems Impacts						
PS-F1: Increased Demand for Existing Energy Sources or Conflict with Adopted Policies or Standards for Energy Use	Negligible	Negligible	Negligible	Negligible	Negligible	
PS-F2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner	Negligible	Negligible	Negligible	Negligible	Negligible	PS-MM-1: Employ Sustainable Building Practices
PS-F3: Conflict with Emergency Response	Negligible	Negligible	Negligible	Negligible	Negligible	
PS-F4: Increased Demand for or Conflict with Utility Lines or Service Systems	Negligible	Negligible	Negligible	Negligible	Negligible	
PS-F5: Increased Solid Waste Demands	Negligible	Negligible	Negligible	Negligible	Negligible	PS-MM-1
4.3.4.5 Human Health and Safety Impacts						
HS-F1: Risk of Accidental Explosion or Release of Hazardous Substances	Negligible	Negligible	Negligible	Negligible	Negligible	WQ-MM-2: Implement Spill Prevention and Control Plan
HS-F2: Exposure of People to Undiscovered or Undocumented Sources of Contamination	Negligible	Negligible	Negligible	Negligible	Negligible	HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/ Remediation
4.3.4.6 Land Use, Planning, and Agricultural Resources Impacts						
None						
4.3.4.7 Noise Impacts						
NZ-F1: Exposure of Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Fill Hauling and Disposal Activities	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	

Note:

* The analysis of the two trail alternatives only considers the effects of hauling the fill to the sites. For the coastal trail, impacts of using the fill to recontour the trail are also considered.

Chapter 1

Introduction

Exhibit 2: Final Environmental Impact Statement

Chapter 1
Introduction

In accordance with Section 102(2)(c) of NEPA (42 U.S. Code [USC] 4321 et seq.), CEQA (California Public Resources Code Section 21000 et seq.) and the State CEQA Guidelines (14 CCR 15000 et seq.), NPS, GGNRA, and the County have prepared a joint Final EIS/EIR to identify and assess potential impacts associated with the Big Lagoon Project.

Organization of the Final EIS/EIR

This Final EIS/EIR is organized as follows:

- **Executive Summary—**A summary of the project alternatives, a description of issues of concern, and a summary of environmental impacts are provided.
- **Chapter 1, *Introduction*—**This chapter describes the project background, purpose and need, the preparation, review, and approval process under NEPA and CEQA, impact topics and those dismissed from further analysis, subsequent approvals for which the Final EIS/EIR will be used, and organization of the Final EIS/EIR.
- **Chapter 2, *Alternatives Description*—**Chapter 2 describes the alternatives formulation process, presents the alternatives, including those considered but dismissed from detailed study, and the preferred alternative.
- **Chapter 3, *Affected Environment*—**Chapter 3 describes the setting related to physical, biological, cultural and social resources. The chapter contains multiple subchapters that each address a specific environmental issue area (e.g., water resources, air quality, traffic).
- **Chapter 4, *Environmental Consequences*—**Chapter 4 describes the impacts of the alternatives. Similar to the Affected Environment chapter, this chapter contains subchapters to address each specific environmental issue area—each describes the relevant regulations and policies, methodology, and thresholds for impact analysis; discusses environmental impacts associated with alternative construction and operation that relate to that topic; and identifies mitigation measures for adverse impacts.
- **Chapter 5, *Other Statutory Considerations*—**Chapter 5 discusses growth-inducing impacts of the alternatives, and issues relating to sustainability and long-term management of the environment.

- **Chapter 6, *Responses to Comments*—**Chapter 6 contains a copy of all comments received on the Draft EIS/EIR during the public review process. Each comment letter, including e-mails and response cards, are presented, followed by NPS's responses to each comment.
- **Chapter 7, *Consultation and Coordination*—**Chapter 7 describes the history of public involvement, and provides a list of preparers and list of Final EIS/EIR recipients.
- **Chapter 8, *References*—**Chapter 7 provides a list of printed references and persons consulted during the preparation of this Final EIS/EIR.
- **Chapter 9, *Additional Reference Material*—**Chapter 9 includes a list of species (identifying common and scientific names), a glossary, a list of acronyms, and an index of key words in the Final EIS/EIR.
- **Appendices—**The appendices consist of the Notice of Preparation (NOP) and Notice of Intent (NOI), comments received during the NOP and NOI review period, the draft Mitigation Monitoring and Reporting Program, and technical background reports and data.

Project Overview

Background

Redwood Creek is a coastal stream located in Marin County, California. The Redwood Creek watershed encompasses a 8.9 square mile area beginning on the southwest slopes of Mt. Tamalpais (elevation 2,571 feet), extending through Muir Woods National Monument, and flowing into the Pacific Ocean at Muir Beach (see Figure 1-1). The larger tributaries to Redwood Creek include Bootjack, Rattlesnake, Spike Buck, Kent Canyon, and Fern Creeks. Green Gulch Creek enters just above the Redwood Creek mouth and accounts for 1.2 square miles of the total watershed area. Streamflow in Redwood Creek is perennial in most reaches, with very low flow in summer and early fall, and higher winter base flows.

The Redwood Creek watershed is unique among watersheds of similar size along the California coastline because it is largely undeveloped and protected as part of county, state, and federal land. Agencies that manage watershed lands include the Marin Municipal Water District, California Department of Parks and Recreation (Mt. Tamalpais State Park), and the NPS (GGNRA and Muir Woods National Monument). Three private communities also reside in the watershed—the community of Muir Beach at the mouth of Redwood Creek, Muir Woods Park, and Green Gulch Farm. The watershed is home to old growth coast redwoods, native coho salmon and steelhead, spotted owls, and the CRLF, as well as many other special-status plants and animals. The creek supports what may be the most southerly run of coastal coho salmon found in the United States, and provides valuable habitat for other threatened species. More than a million people visit the watershed each year to hike the extensive trail system and enjoy its natural beauty and cultural resources.

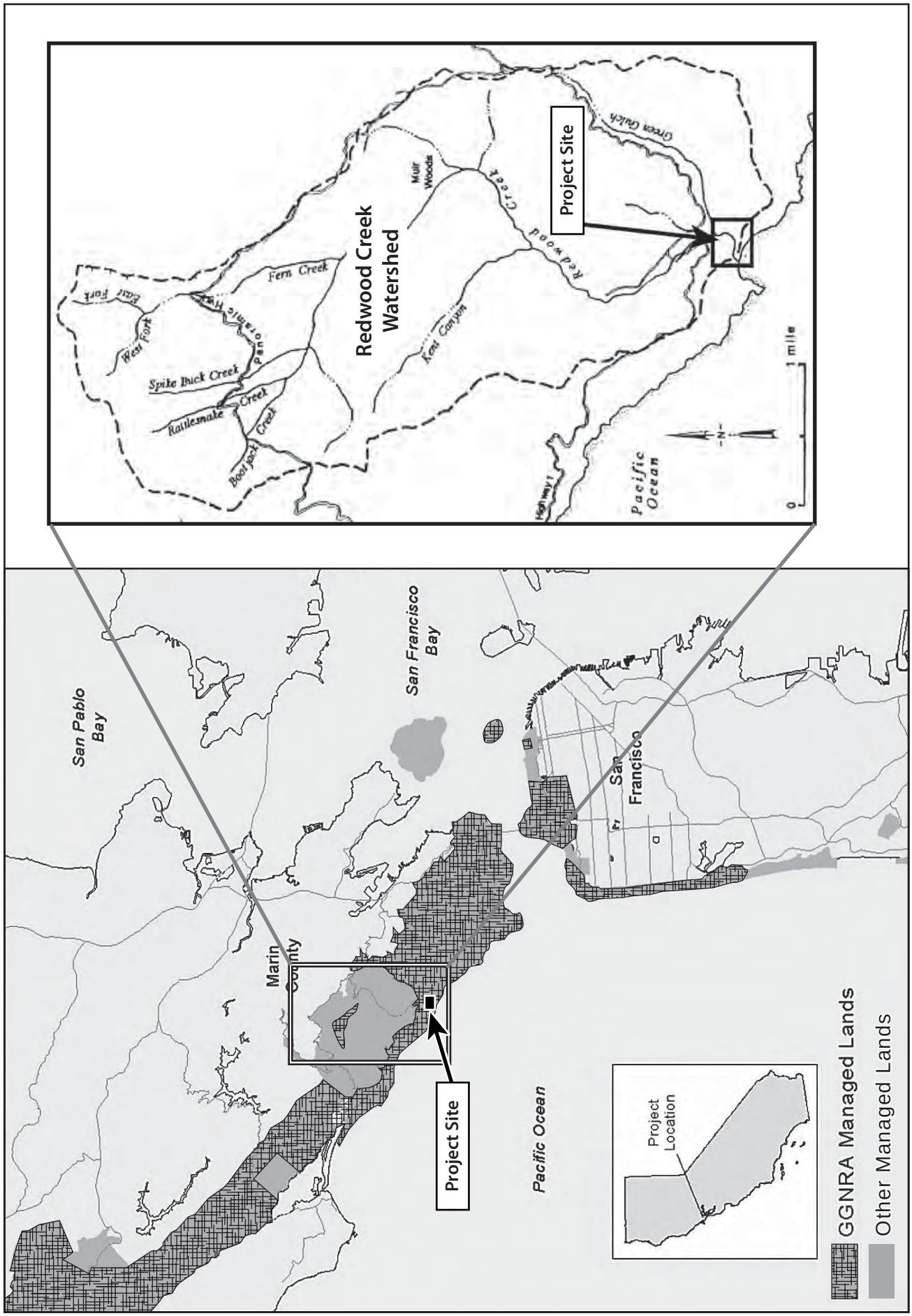


Figure 1-1
Project Location

Jones & Stokes

050520.5 EIR/EIS (rev 12-07)

Exhibit 2: Final Environmental Impact Statement

The project site encompasses the lower reach of Redwood Creek just downstream from where the creek passes underneath Hwy 1, to its mouth at the Pacific Ocean approximately 2,800 feet downstream, at Big Lagoon (Figure 1-1). Big Lagoon itself is a tiny intermittently tidal lagoon with an open water surface area that fluctuates between 0.1 and 1.7 acres annually (Philip Williams & Associates et al. 2003). This is a fraction of the historic extent of open water habitat on the site. The 1853 Coast Survey Map, one of the earliest maps of the area, showed an extensive open water brackish lagoon fringed by emergent vegetation in this reach. Since that time, the area has been extensively modified and the brackish lagoon has filled in; details regarding site modification and related issues are discussed under “Project Need” below.

Planning Area

The project is located at Muir Beach, on the coast of Marin County, California (see Figure 1-1). The project area includes 38 coastal acres at Muir Beach, where Redwood Creek drains into the Pacific Ocean (see Figures 1-2 and 1-3). The project area includes Muir Beach, the intermittent tidal lagoon at the beach, and the entire wetland and creek area extending from just downstream of Hwy 1 to the beach. A wooded area upstream of Pacific Way is also included in the project area.

The San Francisco Zen Center owns about 15 acres of the site; NPS owns the rest of the site with the exception of the alignment of the Marin County–owned Pacific Way, which traverses through the project area. As indicated in Figures 1-2 and 1-3, the Green Gulch Pasture, horse ring, and horse paddock (owned by the SFZC) is bound by the levee road to the west, Pacific Way to the north, and Hwy 1 to the east. The project area west of the levee road and south of Pacific Way, including the parking lot, is owned by NPS. The project area also surrounds the privately owned Pelican Inn property, including an undeveloped fill pad northeast of the inn. Other private parcels are located northeast of the site (such as homes on Pacific Way and Lagoon Drive).

General Description of Project

The project involves three components: (1) ecological restoration, (2) public access upgrades, including a reconfiguration of the existing parking lot, and (3) replacement of the Pacific Way Bridge. All components are designed to improve ecological function.

The ecological restoration component includes alternatives ranging from re-creation of the brackish lagoon that was historically found at the site to restoring the existing creek/riparian system. It also involves enhancement and expansion of the tidal backbeach lagoon, dune restoration activities, invasive species removal, construction of new emergent wetlands, and removal of the levee road and other constructed features on the site. All Restoration Alternatives focus on returning improved and sustainable ecological function at the site.

The public access component includes alternative sizes, locations and configurations of the visitor parking lot to improve the floodplain function in the lower part of the site. As part of the parking lot reconfiguration, the visitor facilities at the beach (restrooms, picnic area, trail and bridge to the beach) would be relocated, and vegetated swales would be installed between the parking lot bays. Other public access amenities that would be constructed include a new pedestrian trail from Hwy 1 to the parking lot, and new interpretive displays and trails.

The Bridge Alternatives consider various designs for a replacement bridge on Pacific Way. Under all alternatives, the new bridge would be higher and longer than the existing bridge to reduce flooding and provide vehicular access. Bridge alternatives vary in length, the height of the roadway approach, and their long-term accommodation of potential channel migration.

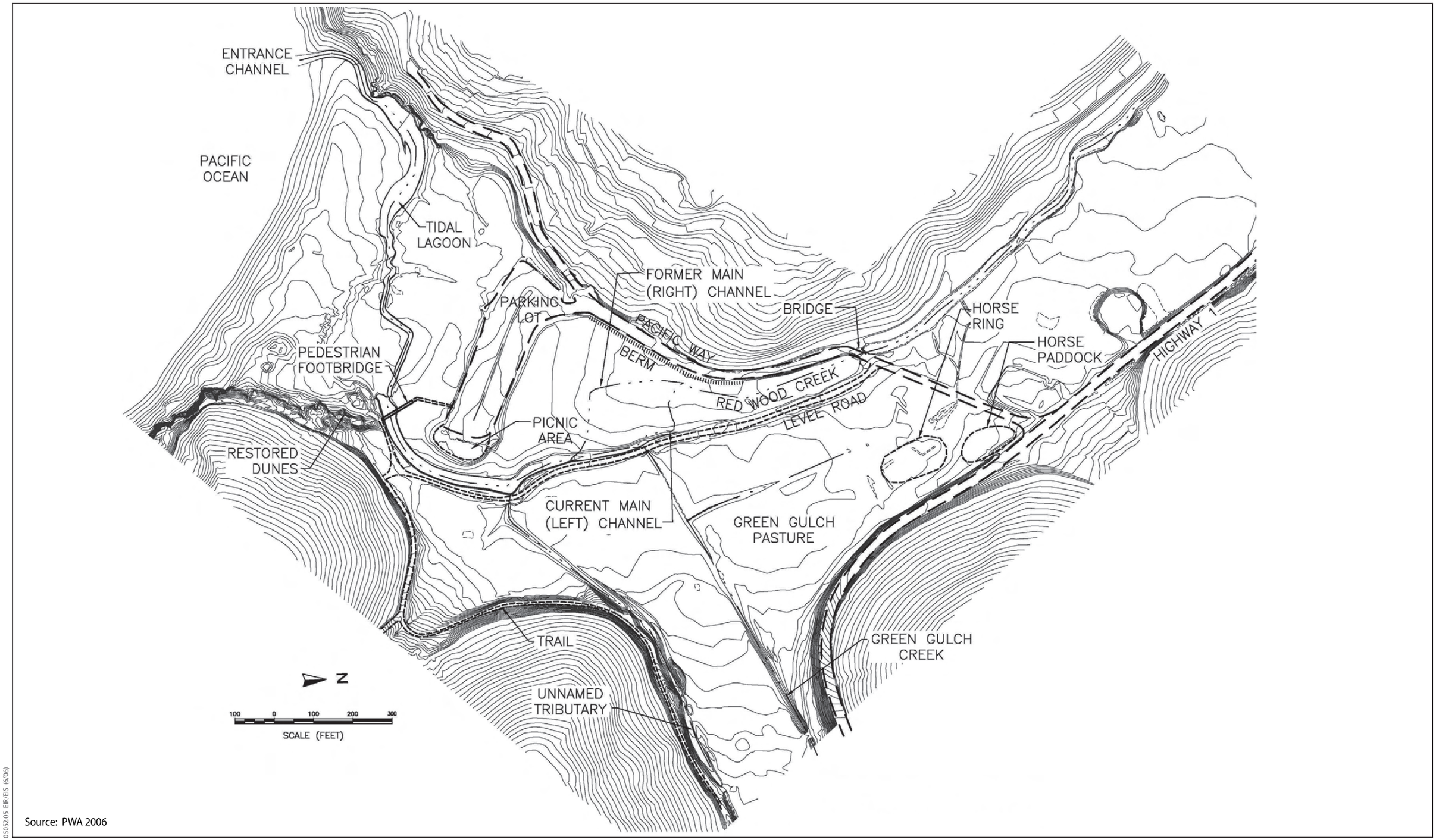
The project also involves flood reduction measures that would be completed in the interim period over the next few years while the larger restoration project is being designed and constructed. These measures would include dredging of the Redwood Creek channel upstream and downstream of the Pacific Way Bridge up to two times prior to completion of the project, as needed, because the creek at the bridge already has reduced capacity to convey high flows, and sediment is expected to continue to build up at the bridge each winter. Removal of accumulated sediment from the box culvert underneath the bridge, as well as clearing of debris jams, would also be conducted, if needed. The goal of this effort is to increase the hydraulic conveyance capacity of Redwood Creek such that out-of-bank flows would be less frequent and the risk of channel avulsion is reduced.

Construction would occur during the dry season over a 3- to 4-year period. During that time, vehicular access would be maintained for local residents at all times, and visitor access to and parking at Muir Beach would be maintained to the greatest extent possible, particularly on weekends.

Project Purpose and Need

Project Purpose

The purpose of the proposed action is to restore a functional, self-sustaining ecosystem, including wetland, riparian, and aquatic components and to conduct the restoration in a manner that will re-create habitat for sustainable populations of special-status species, reduce flooding on Pacific Way, and provide a compatible visitor experience.



Source: PWA 2006

05052.05 EIR/EIS (6/06)

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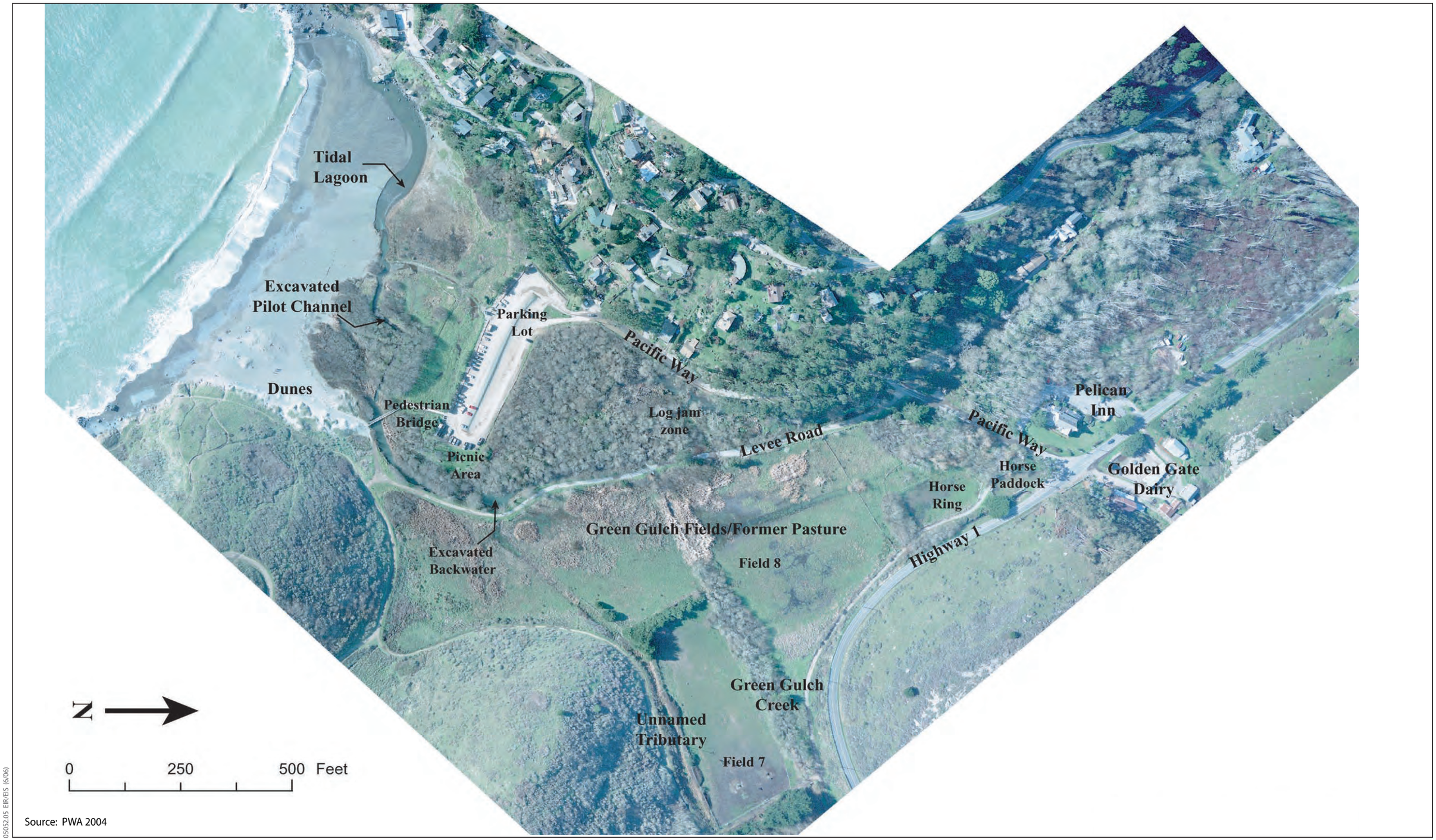
Figure 1-2
Existing Conditions Site Map

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2004

050520.05 EIR/EIS (6/06)

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Figure 1-3
2003 Aerial Photograph

Exhibit 2: Final Environmental Impact Statement

Project Need

Loss of Natural Creek Function

Human modifications in the project area are so extensive that not only does its most prominent original landscape feature—a big lagoon—no longer exist, but Redwood Creek and its associated floodplains, wetlands, and aquatic habitat have steadily lost their natural function. In particular, the ability of the creek to convey high flows to the ocean, carry sediment loads, support rearing habitat for federally-listed salmonids, and flow naturally on floodplains is severely diminished. The landscape once defined by a lagoon that stretched from today's Hwy 1 to the beach is now highly fragmented, both visually and functionally. Redwood Creek is confined by a levee, a public road, a small bridge, and a parking lot, and its natural processes are limited by structures in the floodplain. Landowners installed these features between the 1920s and the 1980s to improve the land for agriculture, recreation, residential access, and commercial enterprises, but the cumulative effect is that the creek in its altered state functions poorly for even its most fundamental purpose of conveying routine winter flows and transporting sediment loads. The most visible consequence of the diminished natural function is the increased frequency of flooding on Pacific Way, which causes road closures at least annually. This project is needed to restore a functional, resilient ecosystem while also providing habitat for special-status species and reducing flooding on Pacific Way.

Hydraulic Obstruction from Parking Lot and Levee

Muir Beach is a very popular coastal attraction for San Francisco Bay Area residents, but its convenient parking lot is a notable obstruction to a functional creek system. The NPS parking lot and adjoining picnic area, serving about 260,000[1] ~~440,000~~ visitors per year, are built on a fill pad three to four feet higher than the adjacent floodplain. The 500 foot–long fill pad extends prominently across the valley, leaving only about 50 feet of width for the creek and its floodplain. High winter flows from an 8.9-square mile watershed from the top of Mt. Tamalpais must wash through this remnant narrow passage to reach the natural end point at the ocean, but the passage is too restrictive, particularly because the opposite side of the creek is also confined by a levee built during the 1960s agricultural era.

In the approximately 25 years since the parking lot fill pad was built, high flows have been obstructed routinely upstream of the parking lot, causing deposition of large loads of sediment that would have otherwise been carried to the ocean. The creek upstream of the parking lot filled with such large volumes of sediment that it lost its channel definition; excess fine sediment buried the whole floodplain between the parking lot and levee road. Fences installed in the 1960s are buried in sediment up to the top of the fence posts. This rapid sedimentation of the creek

[1] The total annual visitors to Muir Beach presented in the Draft EIS/EIR did not reflect the most recent annual visitation survey completed in 2003 (Bignardi pers comm.).

upstream of the parking lot has raised portions of the creekbed to elevations higher than the adjacent Green Gulch pasture. This is a geomorphologically unstable condition with a high risk for channel avulsion, which could cause a sudden migration of the stream channel into the lowest position in the valley. Because it is a substantial hydraulic obstruction, the current parking lot configuration is not compatible with a functional fluvial system. Yet, with a high demand for public access, the project is needed to provide for public access and a visitor experience that is compatible with ecosystem restoration.

Diminished Habitat for Salmonids

Redwood Creek is the southernmost stream in the United States with a healthy population of coho salmon, but its numbers are significantly lower than those of historic populations. Coho in the central coast of California are now formally listed by both the state and federal governments as endangered, and resident steelhead trout are listed as threatened. The habitat in the project area has been diminished both in its areal extent and its quality, with the loss of historic creek and floodplain habitat through landscape modifications. Floodplains are known to provide important habitat for outmigrant coho to feed and build body mass, thereby increasing their chance of survival upon returning to the ocean. Fish passage from the project area's biggest floodplain is often obstructed, however, because a 1,300 foot–long levee across the site provides only two culverts back to the mainstem channel, one of which routinely fills with sediment and requires maintenance. Large woody debris that naturally falls in the main channel and maintains pools with cover is currently removed periodically to facilitate sediment passage and reduce flooding impacts on human development, and sediment has been periodically excavated from the channel. The existing channel conditions led to this conflict between managing for protection of natural resources and managing for flood reduction. This project is needed to regain vital habitat, particularly winter rearing habitat, for federally listed salmonids.

Flooding on Pacific Way

Muir Beach residents and GGNRA visitors access the site via Pacific Way, a Marin County road with a small bridge spanning Redwood Creek. However, water flows over the road routinely each winter, even when other County roads in low lying areas remain passable. Water depths on the road can reach 2 to 3 feet in moderate rain events. This problem has grown noticeably worse in the past two decades as the confined creek has accumulated sediment and lost conveyance capacity. The creek upstream of the Pacific Way Bridge was measured to be about five feet deeper ten years ago; today's shallower creek causes more water to wash over the floodplain and across the road during even minor flood events.

The problem, however, is not a matter of keeping the creek deep enough to pass high flows; the problem is that the road is on a floodplain that will always flood under some events and residents now depend on the road for year-round access. The road was originally built across the floodplain in the 1920s, with a small

bridge over the creek, which was apparently repositioned to the side of the valley. The road sits atop an area that was underwater—a part of the "big lagoon"—in the 1853 U.S. Coast Survey map, and it was remapped in 1892 as a marsh with multiple drainage channels. The road was originally not intended for year-round use, but for access to a tavern and cottages for summer use. The next road upstream from the project area (Hwy 1, to the north) was also built across the floodplain and was also inundated periodically until Caltrans raised the road elevation in the 1970s. The Caltrans solution of raising the road across the entire floodplain cannot be applied to Pacific Way, because structures are now built in the floodplain very close to the road. A higher road all the way across the floodplain, with a small bridge only at one end, would effectively dam the creek during higher flows, and cause an increase in flood elevations at the structures. Some of these structures, such as the Pelican Inn and AT&T utility boxes, sit on fill pads that have collectively reduced the available floodplain width by about 40%, or by about 200 feet out of a maximum of about 475 feet of floodplain width. Although the history of development has had an impact on creek and natural function, the dependency on the road for residential access has created the necessity of reducing flooding on Pacific Way, but this project is needed to provide public access in a manner that is compatible with a natural, resilient fluvial system.

Unsustainable Frog Habitat

CRLFs occur at the project site in a habitat that is maintained by the same structures that make the overall creek system dysfunctional. The 1,300 foot–long levee built in the 1960s to confine the creek also allows water to pond in the Green Gulch pasture. Emergent vegetation grows in the ponded water, providing suitable breeding habitat for the frogs. However, the ponding is dependent on NPS maintaining flashboards on a culvert under the levee each spring and managing it to make sure that water stays ponded long enough to allow successful CRLF reproduction. The number of frogs at the site is so low that their continued existence is in jeopardy, and yet their current habitat is reliant on both human management and a constructed levee that contributes substantially to larger ecosystem dysfunction. There are no other known populations of CRLFs in the Redwood Creek watershed, and as such there is an urgent need to provide hydrologically sustainable habitat for CRLFs in this watershed.

Summary

This project is needed to address the extensive loss of natural function for channel conveyance, sediment transport, channel stability, and diminished habitat for federally endangered coho and federally threatened steelhead; the increased flooding on Pacific Way; and the critical need for sustainable habitat for the CRLF. With many of the impacts resulting from facilities that have accommodated public and residential access, public access is needed in a manner that is compatible with ecosystem function.

Project Goals, Objectives, and Indicators

Goals represent the overarching vision for the project. This project will conduct ecological restoration and public access improvements at Big Lagoon to meet the following goals:

- Restore a functional, self-sustaining ecosystem, including wetland, aquatic and riparian components.
- Develop a restoration design that (1) functions in the context of the watershed and other pertinent regional boundaries, and (2) identifies and, to the extent possible, mitigates factors that reduce the site's full restoration potential.
- Consistent with restoring a functional ecosystem, recreate and maintain habitat adequate to support sustainable populations of special status species.
- Reduce flooding on Pacific Way and in the Muir Beach community caused by human modifications to the ecosystem, and work with Marin County to ensure that vehicle access is provided to the Muir Beach community.
- Provide a visitor experience, public access, links to key locations, and resource interpretation that are compatible with the ecosystem restoration and historic preservation.
- Work with the Federated Indians of Graton Rancheria to incorporate cultural values and indigenous archaeological sites resources into the restoration design, visitor experience, and site stewardship.
- Provide opportunities for public education and community-based restoration, including engaging local and broader communities in restoration planning and site stewardship.
- Coordinate with local transportation planning efforts to identify project features that are compatible with transportation improvements and consistent with the ecosystem restoration.

Project objectives represent specific tasks, milestones, or methods for achieving project goals. To the extent feasible, the alternative restoration approaches strive to satisfy all project objectives. However, certain objectives may be in conflict with each other to some extent—for example, ecological and human use objectives—and thus it may be difficult or impossible to achieve all objectives through a single design approach. With this in mind, conceptual design alternatives were developed with the intent of satisfying as many different objectives as possible.

Project indicators represent simple metrics that can be used to evaluate, either quantitatively or qualitatively, the degree to which each project objective is met. Table 1-1 shows the project indicators identified for each project objective. The same set of project indicators will be used for each action alternative. Note that certain indicators provided below may be too specific to be evaluated at the current conceptual level of restoration design development; some will also require further development as design proceeds. However, all indicators

identified to date are presented here, because they are expected to provide important guidance during future implementation design phases and long-term monitoring and adaptive management. The project objectives and indicators were developed collaboratively by NPS and technical consultants, and were finalized after receiving public comment at Big Lagoon Working Group meetings in 2003.

Table 1-1. Project Objectives and Indicators for Big Lagoon Restoration

Objective	Indicators
Geomorphology/Hydrology	
1. Remove constraints to natural geomorphic processes, such as sediment transport, channel migration, channel-floodplain interaction, and seasonal and long-term beach change.	• Degree that human structures (e.g., bridges, culverts, trails, parking lot, etc.) disrupt sediment transport, limit channel migration, and contribute to flooding. • Width of corridor available for lateral channel migration. • Areal extent of connected 1.5- to 2-year floodplain. • Areal extent of connected 50-year floodplain. • Width of active beach.
2. Rely on geomorphic processes to maintain and support the restoration.	• Anticipated extent of future maintenance required (such as sediment removal, infrastructure maintenance, etc.).
3. Accommodate future watershed sediment delivery.	• Extent that future watershed sediment delivery equals sediment discharge. • The rate of sediment delivery, deposition, and transport is within acceptable ranges (i.e., does not diminish the performance of the restoration project).
4. Restore natural beach processes.	• Capacity of the creek to transport coarse sediment to replenish the beach. • Areal extent of re-created active dune fields. • Extent that the design impacts littoral transport, local littoral sediment budget, and nearshore habitat. • Extent that the design accommodates beach recession due to future sea level rise over the 50-year planning horizon. • Extent that the design accommodates seasonal beach changes and infrequent extreme storm events (e.g., El Niño winter).
5. Accommodate physical disturbance (i.e., extreme hydrologic event, storm surge, sediment pulse, fires, earthquakes, etc.).	• Channel conveyance capacity. • Width of riparian corridor. • Width of active beach. • Ability to accommodate LWD.
6. Restore physical complexity of creek channel.	• Ability to accommodate sudden, large-scale shifts in channel location. • Potential for LWD recruitment. • Channel sinuosity or length of connected channels. • Width of corridor available for lateral migration.

Objective	Indicators
Ecology	
7. Improve coho salmon and steelhead winter rearing habitat.	• Areal extent and quality of low velocity habitats (e.g., instream wood as flow refuge, pools, backwaters, side channels and floodplains). • Complex woody debris or other types of hiding cover from predation.
8. Provide a migration corridor for steelhead and coho salmon.	• Lack of potential barriers (physical barriers, water quality and temperature, water depth and velocity) from estuary to upstream project limit. • Availability of pools for adult holding habitat. • Continuity in landscape configuration during and immediately after implementation that allows migration.
9. Maintain or improve breeding and rearing habitat for CRLF (*Rana aurora draytonii).*	• Areal extent of slow-moving or standing water (10–100 centimeters [cm] deep) within emergent and submergent wetland vegetation during December–March to encourage oviposition (i.e., laying of eggs). • Sufficient water at breeding locations should be available in normal to wet years to allow for successful metamorphosis of tadpoles.
10. Re-establish natural lateral and longitudinal connectivity among channel, floodplain, riparian, and upland habitats.	• Length of transition zones between adjacent habitat types (e.g., channel-riparian, riparian-upland, channel-wetland, wetland-upland, wetland-riparian, dune-wetland) unimpaired by artificial structures or barriers. • Length of riparian corridor (including wetlands) in different width categories (e.g., <10 meters [m], 10–60 m, >60 m).
11. Enhance bird diversity.	• Diversity of types of habitat provided (seasonal wetlands, early successional riparian habitat, mature riparian forest, intertidal wetlands).
12. Provide quality (e.g., high reproductive success) habitat for riparian/wetland-associated birds (particularly neotropical migrants).	• Extent of a wide (60–130 m) riparian corridor (including wetlands). • Floristic and structural habitat diversity. • Presence of natural disturbance events (e.g., winter out-of-bank flows). • Reduction in nest predation pressure.
13. Enhance native dune processes and increase diversity of native dune communities.	• Area of contiguous dune habitat undivided by trails. • Range of dune processes and dune habitat types that will be sustained (including the active foredunes co-formed with particular native plant species, and the more stable backdune formation, characterized by a different assemblage of native plant and animal species).
14. Enhance native wetland and riparian plant assemblages.	• The degree to which the wetland and riparian plant communities are supported by natural surface water, groundwater, and geomorphic processes. • Natural gradient of habitat types (e.g., seasonal wetlands,

Objective	Indicators
	to non-tidal perennial wetlands, to tidal marsh, etc.). • Plant community diversity within and among habitat types (e.g., shaded riparian, seasonal wetlands, perennial wetlands, etc.) that provides native plant propagules for revegetation of patches created by natural disturbance events. • Hydrologic conditions that will support appropriate disturbance regimes to promote habitat-type, age-class and plant diversity as well as structural complexity of vegetation, such as floodplain inundation at an interval appropriate to balance conditions necessary for recruitment of riparian species and also prevent early die-off due to prolonged inundation. • Sedimentation in wetland areas at a rate appropriate to sustain the natural gradient of wetland types. • Area of contiguous wetland and riparian communities undivided by trails, roads or other human structures.
15. Provide a diversity of estuarine habitats	• Diversity of aquatic habitat types (saltwater, brackish, freshwater, shallow water, deeper water, open water, submerged aquatic vegetation, emergent vegetation, intertidal habitats, etc.)
Visitor and Resident Access/Experience	
16. Engage visitors in the natural ecosystem and cultural heritage of the site.	• Character and sequence of experience from vehicle to destination facilities. • Character and potential of interpretive opportunities.
17. Incorporate a broad spectrum of appropriate visitor experiences compatible with resources of the site.	• Variety and range of compatible (i.e., with project) visitor experiences offered. • Relation of potential facilities with resources.
18. Provide convenient access to public use facilities for people of all ages and abilities.	• Relative distance from parking to resource. • Relationship of access route to sensitive resources • Extent of compliance with ADA guidelines. • Extent project exceeds ADA guidelines for special needs visitors. • Number of parking spaces.
19. Provide safe pedestrian access from parking/drop-off areas to public use destinations.	• Number and character of road crossings. • Relative amount of pedestrian traffic on Hwy 1. • Extent of trail separated from roadways. • Size and character of multi-use trails.
20. Provide safe and continuous linkages between currently disconnected trails for all user groups.	• Extent that linkages are provided. • Number and character of road crossings. • Extent of trail separation from roadways. • Size and character of multi-use trails.

Objective	Indicators
21. Provide safe vehicular access to the visitor resources.	• Intersection function/safety. • Proximity of parking access roads to intersection and view obstructions. • Reduction in need or potential to park on Hwy. • Number of vehicular circulation decision points.
22. Minimize access conflicts between public visitors and residential users.	• Projected traffic volume on Pacific Way at residential and commercial intersections. • Extent of pedestrian separation from Pacific Way. • Proximity of parking to residential areas.
23. Minimize land use conflicts between visitor access and adjacent uses.	• Compatibility of adjacent uses. • Proximity of parking. • Character of linkages between uses.
24. Minimize conflicts between access and use of facilities and the natural function of the ecosystem.	• Number and type of stream crossings. • Proximity of sensitive habitats to access routes and use facilities. • Extent of habitat connectivity and fragmentation. • Extent that multi-use (pedestrian, bicycle, equestrian, etc.) trails are expected to cause erosion and sediment generation (due to steepness, use in the wet season, etc.).
25. Provide emergency access through site.	• Ease of access to Coastal Trail south of site. • Travel distance for emergency vehicles. • Potential for congestion along emergency access routes. • Ease of emergency vehicle access to beach.
26. Provide improved access for Muir Beach residents.	• Degree that flooding (water depth, frequency and duration) is reduced on Pacific Way and Lagoon Way.
27. Reduce noise and aesthetic/visual distraction of parking and maintain “rustic character.”	• Distance of parking from residents. • Amount of shading/screening of parking. • Size of parking bays.
28. Avoid adverse impacts to upstream properties that could result from channel adjustment.	• Potential for private properties to be impacted by channel migration and/or bank erosion.
29. Do not increase flood hazards to private property.	• Depth of freeboard between flood elevations for individual homes and estimated peak (100-year) flood levels and storm surge run-up. • Potential for private properties to be impacted by channel migration and/or bank erosion.

Objective	Indicators
Constructability	
30. Provide a restoration approach that can be implemented in a feasible manner.	• Ability to schedule key construction activities to avoid or minimize impacts to fish and wildlife (i.e., work outside of breeding seasons, etc.). • Ability to phase construction so that ample habitat for special-status species is available throughout the construction period. • The degree to which on-site and off-site construction impacts to the community (e.g., traffic, noise, closure of access roads) are minimized. • The degree to which construction impacts to park visitors (i.e., traffic, noise, parking and trail closures, etc.) are minimized. • The degree to which off-site ecological impacts (e.g., due to off-site soil disposal, parking, etc.) are minimized. • For phased implementation, the degree to which maintenance actions (e.g., for roads, emergency access, bridges, trails, visitor access or ecological function) will not be required during interim phases.
31. Develop a restoration plan that can be implemented in a cost effective manner.	• Ability to balance cut and fill volume for earthwork. • Order of magnitude costs for new/relocated infrastructure (Pacific Way Bridge, access roads, parking lot, interpretive and recreational facilities, etc.). • Order of magnitude costs for adaptive management activities (including monitoring).
Cultural Resources	
32. Preserve, undisturbed, indigenous archeological sites in the project area.	• Distance of ground disturbances from the archaeological sites. • Degree to which archaeological sites are covered and armored to prevent erosion. • Distance of potential erosion sources from archaeological sites.
33. In addition to the principle of ecological restoration, the landscape design will be informed by the traditional ecological knowledge of the indigenous peoples of the Central California Culture Area.	• The extent the design and operational management of the restoration employs native plants with traditional cultural uses, and native practices of land management. • Extent to which the Federated Indians of Graton Rancheria, if they so desire, are permitted to tend and gather plant materials for traditional and interpretive uses under a special use arrangement. • Extent of support by the Federated Indians of the Graton Rancheria for cultural aspects of the project design.
34. Make the project area an important focal point of interpretation of history and culture of the Coast Miwok.	• Visitor experiences (e.g., visitor contact station, wayside panels, programs) that are devoted to Coast Miwok history and use of this area.

Project Strategy

NPS has adopted the following project strategy to guide restoration and public access improvements at Big Lagoon.

> To develop a management and restoration program that allows for the natural evolution of the landscape through geomorphic processes by anticipating and directing the seasonal and interannual patterns of flooding, sedimentation, erosion, wind-blown sand, wave action and saltwater mixing, thereby minimizing the need for human intervention, except to reconcile conflicts with desirable human activities.
>
> In taking advantage of the natural geomorphic evolution of the site, we anticipate that we will provide the greatest opportunities to recreate native biodiversity within the ecosystem, as well as specifically provide suitable habitat for focal species within the planning horizon. Most of the habitat objectives… rely on natural processes, driven by natural geomorphic evolution, to provide the desired diversity and function of individual habitat types.
>
> This strategy recognizes that there is a broad spectrum of visitor experiences compatible with the natural and cultural resources of the site that can be developed coincident with the re-establishment of natural geomorphic processes. The restoration approach will provide visitors and residents with opportunities to access natural areas in a manner that is harmonious with the long-term ecological goals of the restoration project. This will be accomplished by developing facilities that serve educational and recreational purposes appropriate to the natural and cultural setting and complementary to a healthy natural environment.
>
> The strategy also seeks to reduce existing flooding by allowing natural geomorphic processes to shape the landscape and by modifying infrastructure to accommodate these processes. Reducing flooding will improve the quality of the visitor and resident experience.

Project Review Process

Overview of the National Environmental Policy Act and the California Environmental Quality Act

When a project[2] is subject to review under both NEPA and CEQA, state and local agencies are encouraged to cooperate with federal agencies in the environmental review process and to prepare a joint environmental document. NPS and the County have determined that the proposed Big Lagoon project could significantly affect the environment and have therefore prepared this joint Final EIS/EIR.

NEPA (42 USC 4321; 40 Code of Federal Regulations [CFR] 1500.1) is the nation's broadest environmental law. It provides an interdisciplinary framework

[2] The term *project* used in this EIR/EIS refers explicitly to the term as defined under CEQ's regulations for NEPA and the State CEQA Guidelines: "the entirety of an action which has a potential for resulting in a physical change in the environment."

for federal agencies to prevent environmental damage and contains action-forcing procedures to ensure that federal agency decision makers take environmental factors into account. NEPA applies to all federal agencies and to most of the activities they manage, regulate, or fund that affect the environment. It requires all agencies to consider and to publicly disclose the environmental implications of their proposed actions through the preparation of appropriate documents. The President's Council on Environmental Quality (CEQ) has adopted regulations and other guidance that provide detailed procedures that federal agencies must follow to implement NEPA. NEPA requires that every federal agency prepare an EIS for proposed legislation or other major federal actions "significantly affecting the quality of the human environment" (42 USC 4332; 40 CFR 1501). This Final EIS/EIR was prepared to comply with the requirements of NEPA and its relevant implementing regulations. NPS is the lead agency under NEPA.

CEQA (Public Resources Code [Pub. Res. Code], Division 13, Section 21000 et seq.) requires state and local agencies to estimate and evaluate the environmental implications of their actions and aims to prevent adverse environmental impacts of those actions by requiring those agencies, when feasible, to avoid or reduce significant environmental impacts. CEQA requires that the lead agency prepare an EIR when the lead agency determines that a project may have a significant effect on the environment. Marin County is the lead agency under CEQA.

Role of Lead Agencies

This project has two lead agency sponsors—the County and NPS. Although it is a joint project, the County and NPS each play a unique role in the project. The County's role is limited to actions related to improvements to Pacific Way and the Pacific Way Bridge. All other actions are the responsibility of NPS. All components of the project are related and necessary to achieve the overall goals and objectives of the project; for this reason, they have been included as the whole of the project.

Public Involvement and Scoping

The intent of both NEPA and CEQA is to establish opportunities for the public to review and comment on projects that may affect the environment. Both NEPA and CEQA provide for public participation through:

- project scoping,
- publication of project NOI to prepare an environmental impact statement/NOP to prepare an environmental impact report,
- public review of environmental documents, and
- public hearings.

NEPA and CEQA also require that a final EIS/EIR include responses to all comments received from the public regarding the draft EIS/EIR. The following sections provide additional information on public involvement in the environmental review process.

Notice of Intent and Notice of Preparation

The purpose of the NOI and NOP is to solicit participation from responsible and coordinating federal, state, and local agencies and from the public in determining the scope of an EIS and EIR. The scoping process was formally initiated under NEPA on December 3, 2002 with the publication of the NOI in the Federal Register (Volume 67, Number 232, Page 71983-71984). The scoping process was formally initiated under CEQA on April 27, 2004 with the submittal of the NOP to the California State Clearinghouse in compliance with CEQA. A copy of the NOI and NOP is included as Appendix A. Comments on the NOI and NOP were provided by a number of agencies, organizations, and members of the public.

Project Scoping

Scoping refers to the process used to determine the focus and content of an EIS/EIR. Scoping solicits input on the potential topics to be addressed in an EIS/EIR, the range of project alternatives, and possible mitigation measures. Scoping is also helpful in establishing methods of assessment and in selecting the environmental effects to be considered in detail. The tools used in scoping this EIS/EIR included a number of public meetings, informal stakeholder and interagency consultation, public scoping meetings, and publication of the project NOI/NOP. The scoping process is described in more detail in Chapter 7, Consultation and Coordination. A scoping summary is provided in Appendix B.

Public Review of the Draft EIS/EIR

The Draft EIS/EIR was circulated to local, state, and federal agencies and to interested organizations and individuals to review and comment on the report. Its publication marked the beginning of a 75-day public review period, beginning on December 22, 2006, the date of EPA's notice of filing published in the Federal Register. Following release of the Draft EIS/EIR, NPS and Marin County held two public meetings to present the project to interested parties and to answer questions about the project. These meetings were held on January 18 and 31, 2007. NPS and Marin County also conducted a public hearing at the Marin County Planning Commission in San Rafael, California, on February 26, 2007, to receive comments on the draft document.

Final EIS/EIR

As stated above, NEPA and CEQA require that a final EIS/EIR include responses to comments received regarding the draft EIS/EIR. This Final EIS/EIR therefore includes Chapter 6, *Responses to Comments*, which includes written responses to substantive issues raised in written and oral comments received during the review period for the Draft EIS/EIR. In addition, revisions to the Draft EIS/ EIR are shown throughout the Final EIS/ EIR as follows: text that has been deleted is shown in ~~strikeout~~, and text that has been inserted is underlined. After review of the project and the final EIS/EIR, County staff will recommend to the Marin County Board of Supervisors whether to approve or deny the portions of the project for which they are responsible. This governing body will then review the project, the final EIS/EIR, staff recommendations, and public testimony before deciding whether to certify the final EIS/EIR and authorize the portions of the project for which they are responsible.

Following NEPA guidelines, NPS will file a ROD in the Federal Register which documents their approval of the action. Review and approval of the EIS/EIR and ROD is handled by the NPS Regional Director. The ROD documents the choice of an alternative, mitigation measures, and the decision rationale. According to the CEQ requirements, the ROD contains: (1) a summary description of all the alternatives analyzed, (2) the environmentally preferable alternative, (3) the decision rationale, (4) a description of which mitigation measures will be implemented, (5) a summary of any monitoring or other enforcement programs or plans, and (6) a statement of whether all practical means to avoid or minimize environmental harm from the selected alternative have been adopted, and if not, why not.

Under CEQA guidelines, if the project is approved and there are significant impacts identified by the EIS/EIR that cannot be mitigated, the County must include a Statement of Overriding Considerations in the record of the project approval and mentioned in the Notice of Determination (14 California Code of Regulations [CCR] 15093[c]).

Public Review of the Final EIS/EIR

This Final EIS/EIR will be circulated to local, state, and federal agencies and to interested organizations and individuals who may want to review and comment on the report. Its publication marks the beginning of a 45~~30~~-day public review period, beginning on the date of EPA's notice of filing published in the Federal Register.

Written comments will be accepted online at http://parkplanning.nps.gov/goga (click the project title and follow instructions). Written comments may also be sent to:

Superintendent
Golden Gate National Recreation Area
Fort Mason, Building 201
San Francisco, CA 94123
Attn: Wetland and Creek Restoration at Muir Beach

All documents mentioned herein or related to this project can be reviewed any Marin County business day between the hours of 8:30 a.m. and 4:00 p.m. at the Marin County Development Agency, located at the following address:

3501 Civic Center Drive, Room 308
San Rafael, CA 94903

Mitigation Monitoring and Reporting

CEQA requires that lead agencies "…adopt a reporting or monitoring program for the changes made to the project or conditions of project approval, adopted in order to mitigate or avoid significant effects on the environment" (13 Pub. Res. Code 21002). Throughout the Final EIS/EIR, mitigation measures have been clearly identified and presented in language that would facilitate establishment of a monitoring and reporting program. Any mitigation measures adopted by NPS and the County as conditions for approval of the project would be included in a monitoring and reporting program to verify compliance. The mitigation monitoring and reporting program for the proposed project has been included in Appendix C.

NPS will document the mitigation measures that it is adopting in the ROD, as described above.

Impact Topics

Impact topics are the resources or values of concern that could be affected, either beneficially or adversely, by the alternatives. The impact topics were identified on the basis of federal, state, and local laws, regulations, orders, *National Park Service Management Policies* (National Park Service 2006a), scoping, and GGNRA/County staff concerns or knowledge. The impact topics include:

- Watershed Processes;
- Water Quality;
- Water Supply;
- Air Quality;
- Vegetation Communities and Wetlands;
- Wildlife and Wildlife Habitat;
- Fisheries;

- Cultural Resources;
- Recreation and Visitor Experience;
- Traffic and Circulation;
- Aesthetics;
- Energy, Public Services, Utilities, and Service Systems;
- Human Health and Safety;
- Land Use Planning and Agriculture; and
- Noise.

Impact Topics Dismissed from Further Analysis

The topics listed below would either not be affected or would be affected negligibly by the alternatives. Negligible effects are those that are localized and immeasurable at the lowest level of detection. Therefore, these topics have been dismissed from detailed analysis.

Night Sky

Because Muir Beach is not open after dark, there are no lights at the parking area and traffic on Pacific Way is generally limited to residents of the Muir Beach community. None of the project alternatives that are proposed as part of this plan would increase or decrease night traffic. Nor are any streetlights or other sources of new light pollution proposed as part of this plan. Construction efforts would not adversely affect night views because construction activities would be limited to daylight hours between 8:00 a.m. to 5:00 p.m. Therefore, this topic was dismissed.

Wilderness Values

The Wilderness Act of 1964 (16 USC 1131 et seq.) established a national wilderness preservation system. Within the study area, there are no designated wilderness areas and therefore, this topic was dismissed.

Indian Trust Resources

Indian trust assets are owned by Native Americans, but are held in trust by the United States. Secretarial Order 3175 (“Identification, Conservation and Protection of Indian Trust Assets”) requires that any anticipated impacts to Indian trust resources due to a proposed project or action by agencies within the Department of the Interior be explicitly addressed in environmental documents. Because the lands within the park boundaries are not held in trust by the

Secretary of the Interior for the benefit of Indians due to their status as Indians, this topic was dismissed.

Wild and Scenic Rivers

The Wild and Scenic Rivers Act of 1968 established the National Wild and Scenic River System to protect the nation's highest quality natural rivers. There are no designated wild and scenic rivers within the study area, therefore this topic was dismissed.

Mineral and Paleontologic Resources

The project area does not contain any known mineral or paleontologic resources. For this reason, this topic was dismissed.

Environmental Justice

Executive Order (EO) 12898 ("Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations") requires that all federal agencies incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. According to the U.S. Environmental Protection Agency (EPA), environmental justice is the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies. Because there are no minority or low-income populations or communities at or adjacent to the project site, and the visitors to Muir Beach consist of a broad spectrum of demographic and economic groups, the alternatives would not have disproportionate health or environmental effects on minorities or low-income populations or communities as defined by the EPA, this topic was dismissed.

Population/Housing

CEQA requires consideration of whether the project would displace housing or people, necessitating the construction of replacement housing elsewhere. Because the project would not result in these effects, they have not been considered further, and this topic was dismissed.

Intended Uses of Final EIS/EIR

As indicated above, the Final EIS/EIR is an information document for decision-makers. CEQA and NEPA require that the decision-makers review and consider the Final EIS/EIR in their consideration of this project. GGNRA and the County are the lead agencies under NEPA and CEQA, respectively. Agencies with subsequent permit review or approval authority over the project are summarized in Table 1-2. These are responsible agencies under CEQA and will use the Final EIS/EIR as the environmental basis of their decisions.

Table 1-2. Summary of Local, State, and Federal Discretionary Actions

Agency	Permit/Review Required
GGNRA	▪ NEPA Lead Agency—project approval
County of Marin	▪ CEQA Lead Agency—project approval
	▪ Encroachment Permit for NPS work in County right-of-way
	▪ Grading Permit, if NPS earthwork occurs on private property (e.g., SFZC property)
	▪ Creek Permit, if creek restoration activities occur on private property
California Department of Fish and Game (DFG)	▪ Incidental take permit, if state-listed species is affected
	▪ Streambed Alteration Agreement, if activities occur within the stream zone on private property
Caltrans	▪ Encroachment Permit (if in Hwy 1 right-of-way)
Regional Water Quality Control Board (RWQCB)/ State Water Resources Control Board (SWRCB)	▪ National Pollutant Discharge Elimination System Construction Activities Stormwater General Permit
	▪ Dewatering Permit (if needed)
	▪ Federal Clean Water Act Section 401 Water Quality Certification
USACE	▪ Permit under Section 404 of the federal Clean Water Act (CWA) and Section 10 of the federal Rivers and Harbors Act
U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS)	▪ Consultation under Section 7 of the federal Endangered Species Act
	▪ Authorization for work below mean high tide (i.e., within the Gulf of the Farallones National Marine Sanctuary) (NMFS)
State Historic Preservation Office (SHPO)	▪ Compliance with Section 106 of the National Historic Preservation Act
California Coastal Commission (CCC)	▪ Coastal Development Permit (County actions on non-federal land); Consistency Determination (NPS)

Exhibit 2: Final Environmental Impact Statement

Chapter 2

Alternatives

Exhibit 2: Final Environmental Impact Statement

Chapter 2
Alternatives

This chapter identifies a range of alternatives that represent technically feasible approaches to meeting the proposed project's stated purpose, and describes the process used by the lead agencies to formulate the range of project alternatives. It presents the environmental and agency constraints and policy, legislation, and site characteristics considered in identifying the alternatives to be carried forward for Final EIS/EIR analysis. The project purpose and need, which also guided alternatives formulation and screening, is discussed in detail in Chapter 1.

NEPA and CEQA Requirements for Alternatives

NEPA and its implementing regulations require that an EIS evaluate a reasonable range of feasible alternatives to the proposed action. Although the No Action Alternative is not the baseline for evaluating environmental effects[1], the EIS must also evaluate the No Action Alternative, to allow decision makers to compare the effects of approving the proposed action with the effects of not approving it. Alternatives must be evaluated in the same level of detail provided for the proposed action (40 CFR 1502.14).

Similarly, CEQA requires that an EIR consider alternatives that would avoid or reduce one or more of the significant impacts identified for the proposed project. Under the state's CEQA Guidelines, the EIR does not need to consider all possible alternatives; rather, the alternatives considered should be limited to a reasonable range that would meet the project objectives, appear to be feasible, and would avoid or substantially lessen at least one of the project's significant environmental effects. Like NEPA, CEQA requires analysis of the No Project Alternative to allow decision makers to assess the effects of not moving forward with the proposed project. CEQA does not require the alternatives to be evaluated in the same level of detail as the proposed project. However, EIRs are required to include sufficient information about each alternative to allow meaningful evaluation, analysis, and comparison with the proposed project or program (CEQA Guidelines Sec. 15126[d], 15126.6[a], 15126.6[f]).

[1] The baseline for impact analysis is defined as environmental conditions at the time the NOI/NOP was published.

Alternatives Formulation Process

Caltrans 1994 Preliminary Environmental Assessment[2]

Preliminary design alternatives for the project site were developed in the early 1990s by Caltrans, working with NPS and other agencies, as mitigation for repair of the Lone Tree Slide on Hwy 1 near Stinson Beach. These alternatives were described in a Preliminary Environmental Assessment (EA) completed for the Caltrans project (Phillip Williams & Associates 1994), which summarized natural conditions and historic changes at Big Lagoon; described existing and anticipated future conditions; and identified restoration objectives. Using these as a basis, opportunities and constraints at the site, including physical, ecological, and land use characteristics, were evaluated, and four Restoration Alternatives were developed for the site:

1. restoring the historic wetland,
2. restoring the historic wetland and preserving riparian woodlands,
3. expanding the backwater ponds into the lower pasture at Green Gulch Farms, and
4. enlarging the tidal lagoon and restoring dunes.

In addition, several parking alternatives were identified but not considered further. The four Restoration Alternatives involved excavation volumes ranging from 3,600 to 120,000 cubic yards, and a preliminary investigation of potential disposal locations for cut materials was also conducted in the EA. However, the project was never implemented.

~~Current~~ Development Process

The GGNRA reinitiated planning for the site in 2002. The current planning effort builds on work completed for the 1994 EA, but incorporates new assumptions and current information. In particular, the project boundaries have been expanded to include 6.75 acres of NPS-owned lands upstream of Pacific Way to allow a fuller integration of channel alternatives; this is intended to reduce flooding on Pacific Way and allow more complete restoration of natural creek function. The current project also includes plans to reconfigure or move the NPS visitor parking lot at Muir Beach and reconfigure the Marin County–owned Pacific Way Bridge over Redwood Creek.

[2] Note that while the 1994 EA was called an "Environmental Assessment," it was not a NEPA document.~~prepared with the intent of fulfilling NEPA requirements.~~

Between December 2002 and December 2004, 17 public meetings were held, as well as a variety of site visits and meetings with representatives of various agencies. On December 3, 2002, a NOI to prepare an EIS was published in the Federal Register, beginning the formal scoping process for the project. The NOI identified goals for the project, and public scoping meetings were held on October 22, October 29, and November 2, 2002, with a site visit for the public held on November 9, 2002, to solicit input on the project and its potential impacts. Following these meetings, a Big Lagoon Working Group consisting of interested individuals, agencies, and organizations was formed to help develop project alternatives. The working group convened regularly in meetings that were open to the public. In addition, two alternatives workshops were held for the public on September 30 and October 4, 2003. The results of those workshops, as well as a more detailed summary of the scoping process, are presented in the Alternatives Public Workshops Report (National Park Service 2004). Finally, Marin County circulated a Notice of Preparation of an Environmental Impact Report on April 27, 2004, soliciting comments on the specific issues to be included in the scope of CEQA environmental review. All of these activities informed the alternatives formulation process.

Concurrent with the activities described above, NPS and other entities have conducted studies and prepared technical documents to develop baseline site information and develop conceptual restoration design alternatives. The Site Analysis Report (Philip Williams and Associates et al. 2003) expanded on the 1994 EA to describe the site in more detail, developing a conceptual model for Big Lagoon's physical and ecological functions prior to disturbance following European colonization; identifying watershed changes and other factors that have led to the site's current condition; and discussing existing conditions at the site. A sediment budget was also developed for the Redwood Creek Watershed comparing historic and current sediment loads to the creek (Stillwater 2004). These and other investigations, together with the public involvement process described above, resulted in the Feasibility Analysis Report (Philip Williams and Associates et al. 2004), which defined more specific strategies, goals, objectives, and indicators for the site, evaluated opportunities and constraints, and presented three ecological Restoration Alternatives and four Public Access Alternatives. These restoration and Public Access Alternatives served as the basis for the alternatives evaluated in the EIS/EIR. Alternatives described in the Feasibility Analysis Report were peer-reviewed by the San Francisco Bay Wetlands Restoration Group, Design Review Group, in early 2004. The peer review comments led to a re-evaluation of whether more minimal restoration actions could be taken, additional proposed actions for the intermittent tidal lagoon, and additional scrutiny of sediment dynamics related to the project function (San Francisco Bay Wetlands Restoration Program, Design Review Group 2004). Public access alternatives were modified from those presented in Philip Williams & Associates et al. (2004) to provide a broad range of alternatives and to reflect additional input from stakeholders.

Over the course of the extensive public outreach process conducted for the Big Lagoon site, numerous other alternatives have been suggested that are not under detailed consideration at this time. A summary of alternatives considered but

eliminated from further study, including the reasons for their dismissal, is presented later in this chapter under the heading *Alternatives Eliminated from Further Study*.

Alternatives Analyzed in Detail

This section presents the range of alternatives analyzed in detail in the EIS/EIR.

As identified above, in addition to No Action (no restoration, no changes in public access), three ecological Restoration Alternatives, six Public Access Alternatives, and four bridge replacement options are under consideration at this time. The project will ultimately consist of one restoration alternative combined with one Public Access Alternative and one bridge design. As shown in Table 2-1, many combinations are possible. However, some combinations have already been ruled out as infeasible because they would combine fundamentally incompatible approaches; for instance, restoration of a large lagoon on the site would be physically incompatible with development of parking located at the beach, so these alternatives would not be combined.

Table 2-1. Possible Combinations and Their Compatibility/Feasibility—Restoration Alternative and Public Access Alternative

	Restoration Alternatives			
Public Access Alternatives	Alternative 1: No Action	Alternative 2: Creek Restoration	Alternative 3: Creek and Small Lagoon Restoration	Alternative 4: Large Lagoon Restoration
A—No Action	**Yes**	No	No	No
B1—50 Cars at Beach	No	**Yes**	**Yes**	Yes[1]
B2—145 Cars at Beach	No	**Yes**	**Yes**	No
B3—175 Cars at Beach	No	**Yes**	**Yes**	No
B4—175 Cars Rotated Parallel to Pacific Way	No	**Yes**	**Yes**	No
B5—200 Cars at Beach	No	**Yes**	**Yes**	No
C—118 Cars at Alder Grove plus 14 Spaces for Disabled and Drop-Off at Beach	No	**Yes**	**Yes**	**Yes**

Notes:

All Bridge and Fill Disposal Alternatives are compatible with the various Public Access and Restoration Alternatives.

Yes = Combination identified as feasible.

No = Combination identified as incompatible/infeasible.

1. Note that while this combination is technically feasible, it is not evaluated in this Final EIS/EIR as it is unlikely to be implemented. Should it be determined in the future that this alternative may be implemented, additional CEQA/NEPA analysis would be necessary.

Several alternatives are also under consideration for disposal of excavated materials (Fill Disposal Alternatives). The construction scenario, and ongoing maintenance and management, would be broadly similar under all alternatives combinations.

The following sections describe the No Action Alternative and the action alternatives. Discussion of the action alternatives includes

- the activities common to all action alternatives (i.e., tasks that would be accomplished under all restoration and public access approaches);
- the three restoration approaches;
- the six public access approaches;
- the four bridge options;
- alternatives for fill disposal;
- construction scenarios; and
- ongoing maintenance and management under the action alternatives.

Alternative 1—No Action

Under the No Action Alternative (Figures 2-1 and 2-2), Redwood Creek would remain in its current alignment, and no large-scale physical modifications of the site would occur. Pacific Way road and bridge would remain unchanged in size and design and would continue to serve as the primary access route to the parking lot, which would also remain unchanged at its current location, as well as for residences along Pacific Way and Lagoon Drive. Visitors would continue to reach the beach via the existing footbridge, and area trails—such as the internal loop trail and access to the southerly Coastal Trail—would remain as they are now. The levee road, currently used as an emergency access route, would remain in place along Redwood Creek from Pacific Way to the toe of the southerly Coastal Trail. The picnic area and restrooms would remain in their current location adjacent to the parking lot.

The No Action Alternative would allow continued periodic flooding of Pacific Way during storm events, resulting in the need for emergency intervention to prevent prolonged road closures. Periodic maintenance, including dredging, would continue to be needed to remove sediment and fallen trees from Redwood Creek, although its implementation would be hindered by the difficulty in obtaining permits from regulatory agencies for such actions. Channel avulsion of Redwood Creek (i.e., sudden relocation of the channel alignment during a large storm) would be likely under this alternative as the existing channel, in its confined condition, continues to aggrade (i.e., build up with sediment) in response to elevated sediment delivery from the watershed. Channel avulsion under the No Action Alternative could create fish passage impediments due to either shallow sheetflows during migration periods and/or the presence of the levee road, which can block reentry of waters to the existing creek channel.

Active seasonal management of the culvert and flashboards in the lower Green Gulch pasture would continue to be necessary to maintain ponded surface water for the CRLF.

In addition, the No Action Alternative provides sub-optimal salmonid habitat due to fragmentation of winter rearing habitat, in-channel conditions lacking refugia, and out-of-bank flows that do not provide for easy salmonid reentry into the main channel.

Without active maintenance of Redwood Creek, the lower reaches of Redwood Creek in its confined state would continue to lose flow capacity as a result of sediment deposition up- and downstream of the Pacific Way Bridge. This would likely result in future increased flooding and difficult access for residents and visitors, the eventual sedimentation of Redwood Creek, and the overall degradation of natural geomorphic processes at the site. The loss of healthy creek processes would undermine the capacity for healthy salmonid habitat.

Action Alternatives

Activities Common to All Action Alternatives

Because all of the Restoration Alternatives focus on reconstructing natural geomorphology and function at the Big Lagoon site, all would be guided by the same strategy, and all would have certain key project elements in common. The same is true for the Public Access Alternatives, all of which stress reduction in hydraulic impacts with improved public access to a functionally and visually restored Big Lagoon site. To avoid redundancy, the following sections present an overview of the strategic and project elements that would be implemented with all action alternatives for restoration and public access.

Restoration Activities Common to All Action Alternatives

Because they are guided by the same goals and objectives, all of the restoration approaches would entail some of the same activities. The activities common to all Restoration Alternatives are described in the following sections.

Interim Flood Reduction Measures

Flood reduction actions by NPS or Marin County are proposed as interim actions common to all alternatives since construction of restoration, public access and bridge components will require up to three years and will not be completed until about 2010 or 2011, depending on funding availability. The interim actions are necessary because ongoing channel aggradation contributes to (1) flooding under low-magnitude, high frequency storm events and (2) the risk of channel avulsion. Frequent out-of-bank flows from Redwood Creek have resulted in side channels that have been eroded in the floodplain upstream of Pacific Way, and the channel is at risk of avulsion in this area (Klein et al. 2002). These conditions will persist

and likely grow worse in the interim period before the larger restoration project is completed.

To address both issues (flooding and risk of avulsion), interim actions are focused on maintaining flow under the Pacific Way Bridge during low magnitude events, since the reduced capacity under the bridge forces flows onto the floodplain (Klein et al. 2002). As of May 2006, the channel bed is about four feet below the bridge soffitt (or lowest part of the bridge). The channel bed elevation increased about 2.5 feet in 2005-06 at the upstream side of the Pacific Way Bridge (Environmental Data Solutions 2006).

Proposed interim flood reduction actions consist of excavating the channel from a maximum of about 400 feet upstream of the Pacific Way Bridge to about 100 feet downstream of the bridge. Up to about 3 feet of material would be excavated from this reach, for a total of about 1,600 cubic yards during a single excavation. A more limited reach of the channel would be excavated if channel bed elevations in this reach are lower than those in 2006. An excavator or similar equipment would be used to remove the sediment. Equipment is expected to be taken into the channel to conduct the excavation.

For purposes of analysis, flood reduction actions at the Pacific Way Bridge are proposed to be conducted two times before construction of the restoration project is completed if the channel bed at the Pacific Way Bridge is about four feet or less below the bridge soffit. Other limited actions would consist of removing sediment within Marin County's 40 foot–wide right-of-way on the upstream and downstream sides of the bridge; this could be done without taking equipment into the creek channel. Interim actions would include removing log jams in the project area only if they are shown to be obstructing flood flows or contributing to sediment aggradation that is worsening flooding or the risk of channel avulsion.

Excavated material would be transported to the unused reservoir pit (described below under the Fill Disposal Alternatives) for temporary storage. Excavated material may be used during the implementation of other project actions, such as when existing reaches of the creek are backfilled following construction of a new channel alignment.

All interim flood reduction actions would be conducted during the low flow period, between August 1~~15~~ and October 31. Cofferdams would be established at the upstream and downstream end of the work areas, to prevent turbidity in downstream areas during the work. Flow downstream of the work areas would be maintained by pumping the creek flow around the work area. Fish would be removed from the work area prior to establishing the coffer dams by using seines, dip nets and electro-fishing methods, and fish nets would be extended across channel both upstream and downstream of the work area to prevent them from re-entering during the work. All fish would be removed and relocated to other locations in Redwood Creek per requirements of the National Marine Fisheries Service (NMFS).

Relocation of Redwood Creek Channel

For each action alternative, the Redwood Creek channel from the upstream project boundary to approximately 100 feet downstream of Pacific Way would be relocated approximately 100–200 feet to the northeast of its existing alignment. The proposed location of the new channel generally follows the topographically lowest portion of the valley, minimizing the potential for future channel avulsion. Because this low point is very close to the Pelican Inn, the new channel would be located approximately 150 feet from the Pelican Inn driveway at Pacific Way. The gradient of the new channel in this location would be tied to the gradient of the channel upstream of the project area. The new creek in this location would be about 5 feet deep and would include low sloping berms to re-create the form of natural depositional levees that would occur in this reach. These low berms would confine bankfull (Q1.5–2)[3] flows upstream of Pacific Way, and support riparian vegetation that would help maintain the channel form, increasing sediment transport and channel sustainability. Most of the existing channel would be back filled upstream of Pacific Way under Alternatives 3 and 4, but most of this reach would not be filled under Alternative 2 to create a backwater channel for use by salmonids and to increase flood storage capacity.

Construction of New Drainage Swale and Upper Pasture Modifications

Under all restoration approaches, a drainage swale would be constructed downstream of Pacific Way between the realigned creek channel and the eastern project boundary. The purpose of the swale would be to collect runoff that would otherwise gather at the base of the eastern berm of the realigned creek. The swale would be very gradually sloped and approximately 1–2 feet deep. It would drain through a new pond with emergent vegetation to Green Gulch tributary under Alternative 2, to the eastern lagoon under Alternative 3, and to the large lagoon under Alternative 4.

Fencing around an equestrian ring on the southwestern side of the access road would be removed under all alternatives, and the area would be revegetated with seasonal wetland vegetation. The ring is currently used by equestrians during the dry season only, but equestrian use of this area would no longer be available. Restoration alternatives do not call for removal of horse stalls on the northeast side of the access road, at the intersection of Hwy 1 and Pacific Way.

Backbeach Lagoon Enhancement, Channel Realignment, and Dune Restoration

In order to enhance the natural dynamic quality of the backbeach lagoon and encourage inland dune formation, all action alternatives would include excavation along the landward side of the intermittently tidal lagoon. The excavation would be approximately 100 feet wide and would encompass the entire length of the lagoon. The excavation depth would be as much as 4 feet, or

[3] "Q" refers to the recurrence interval of the flow event. A Q2 event would be the 2-year recurrence interval flow event, or the flow that has a 50% possibility of happening in any given year. Similarly, a Q100 event would be the 100-year recurrence interval flow event, or the flow that has a 1% possibility of happening in any given year.

somewhat deeper than the roots of the existing vegetation. This would enlarge the lagoon habitat, which is expected to vary in size seasonally and as a result of interannual variation in flows and sediment loads. Wave action and inundation by ponded lagoon water would discourage vegetation establishment, allowing windblown sand to reconstruct the historic dune field.

Each action alternative would also include installation of LWD in the lagoon or at its edge to enhance habitat for juvenile steelhead and salmon by providing additional cover and contributing to development of deeper scour pools. The LWD would consist of large diameter logs with rootwads. A variety of installations would be used, including embedding some logs vertically for stability, leaving some on the surface, and embedding some at an angle.

Additionally, the stream channel downstream of the existing footbridge ~~would~~ may be shifted seaward from its existing location to an alignment consistent with the 1853 map and early aerial photographs of the site. As described in the pre-Euroamerican conceptual model presented by Philip Williams & Associates et al. (2003), high flows in the winter scoured a channel along the back beach to the ocean. With the present location, channel scour is constrained by locally cohesive soils which may be a remnant of dams constructed at that location in the 1960s and 1970s and which were further reinforced by willows and alders that became established there. The new channel would be excavated into more erodible sand to allow for increased channel scour and improved drainage of upstream portions of the site in winter months. Willows, the consolidated soils, and oversized rubble in this area would be removed to regain more natural, less constrained channel processes. The more erodible alignment of the channel downstream of the pedestrian bridge will also enable scouring of the intermittent tidal lagoon. Furthermore, the existing riprap on the left bank of Redwood Creek upstream of the footbridge would be removed to provide added support of natural channel processes.

Each of the three Restoration Alternatives proposes the same improvements to native dune communities by enhancing dune processes between the existing parking lot and tidal lagoon. Under all three restoration approaches, dune enhancement would rely on the possible natural lowering of the water table following excavation of the new creek channel to the tidal lagoon, combined with wind activity to develop dunes from newly dry (hence, erodible) sands. Dunes are most likely to form toward the southeast end of the beach, due to the direction of prevailing winds. Because dunes are sensitive to human and animal trampling, all restoration approaches would use fencing or other means to restrict public access to dune restoration areas. In addition, revegetation of native dune vegetation may be implemented to improve dune formation and quality. New fencing would be installed to allow reestablishment of foredunes, to the south or ocean-side of the existing backdune lobes. With establishment of native foredune vegetation, the foredunes are anticipated to capture fine sand, thereby reducing the sand washed or blown into the new channel.

Removal of Levee Road

The levee road on the northeast side of the creek would be removed under each action alternative to allow lateral channel migration and the ability to reconnect Redwood Creek to its former floodplain. Note that the ultimate function of the former levee road would vary by alternative. All fencing along the levee road, as well as through the Green Gulch pasture, will also be removed.

Invasive Species Removal

All action alternatives would remove invasive non-native plant species . In particular, Cape ivy and non-native invasive perennial grasses, such as kikuyu grass, panic veldt grass, Harding grass, and tall fescue would be removed from various locations at the project site. Nonnative species outside the project boundary that would be likely to spread to the project site would also be targeted for removal, particularly the Harding grass in the alluvial fan south of the project boundary. Himalayan blackberry, the non-native blackberry, and other non-natives would also be targeted for removal.

Cape ivy removal would be prioritized in the approximately 6- to 7-acre alder grove upstream of Pacific Way to preclude its spread into new downstream areas after the channel is realigned. The Green Gulch tributary portion would also be included as part of this first phase. The second priority would be removal in the riparian area adjacent to the parking lot, since this area could be contained temporarily, preventing reestablishment. The total area where Cape ivy removal could be conducted in any one year would be coordinated with the U.S. Fish and Wildlife Service (USFWS) as part of the project's formal consultation for potential impacts on CRLFs. The ivy would be cut and raked, with 3 years of follow-up to remove sprouts. Generally, about 98% of Cape ivy cover is removed in the first year's activities, but 2 years of persistent follow-up is required to ensure eradication of the remaining 2%. Removal would rely on manual techniques; a formal consultation, under Section 7 of the federal Endangered Species Act (ESA), on Cape ivy removal prohibits herbicide use within 150 feet of Coho salmon habitat. The presence of CRLF at the site would likely also preclude herbicide use.

During construction, kikuyu grass would be excavated to rooting depth (approximately 1 foot) at locations where it occurs at the project site, particularly shoreward of the existing parking lot and at the intersection of Green Gulch Trail and the existing levee road, along the levee road, and at more isolated locations around the edges of the site. The removed plants would be composted at a local site or disposed of at an appropriate facility that accepts green waste. This excavation would create additional wetlands in the short-run and, possibly converting to dunes in the long-run with the build-up of wind-blown sand.

Removal of Tavern Remnants

Under all action alternatives, remnants of the non-historic Muir Beach Tavern between the parking lot and the mouth of Redwood Creek/inboard end of the tidal lagoon, in the southwest portion of the project site, would be removed. The remnants include ~~the foundation of the tavern chimney, the remnants of the tavern chimney,~~ concrete sidewalks and a concrete retaining wall or curb along

the northern side of the mouth of Redwood Creek. The tavern chimney would not be removed.

Removal of Utility Lines

Each action alternative would involve the removal and relocation of utility poles and phone and electric lines along the levee road and near Pacific Way. The lines through the wetland area may be placed underground beneath Pacific Way, instead, but utility poles closest to the Pacific Way homes are expected to remain in place. Two poles through the Alder Grove upstream of Pacific Way may also be repositioned to accommodate the new channel alignment. The two existing AT&T utility boxes and their fill pad on the west side of Pacific Way at the southeast end of the proposed bridge would be moved to a serviceable location determined in coordination with AT&T during the project design. Additionally, the Muir Beach Community Services District (MBCSD) water line that runs along the upstream side of Pacific Way and beneath the existing Pacific Way Bridge would be attached to the new bridge. Finally, a decommissioned well pump and associated aboveground power lines across Green Gulch pasture would be removed. The well pump is located along the levee road upstream of the footbridge, and the lines extend from this location to the east corner of the project site.

Removal of Concrete Channels and Revetment

Under each action alternative, gabions and other channel armoring upstream of the existing footbridge would be removed to allow the restored channel to migrate more naturally. In addition, concrete channels ~~along Green Gulch Creek and~~ in the unnamed tributary in the project area would be removed, as would the concrete weir structure controlling flows between the existing emergent wetlands and Redwood Creek channel and the culvert from Green Gulch Creek under the levee road to Redwood Creek.

Modifications to Green Gulch Field 7

The project boundary for all alternatives runs through the lower portion of Green Gulch Field 7, where Ocean Riders currently pasture four horses under an agreement with the San Francisco Zen Center. Under all alternatives, the windrow of Monterey cypress trees on the southwest edge of the field would be removed. Some of these tree trunks may be large enough for reuse as LWD to benefit salmonids and would be retained for this purpose. Fencing around the perimeter of Field 7 will be adjusted to reflect the new project boundaries. An existing horse shelter would be relocated in the new boundary of Field 7. The boundary adjustment for Field 7 would reduce available area for horse pasturing by about 25%, and would likely lead to the loss of pasture for one of Ocean Rider's horses in Field 7.

Cultural Resource Enhancement

The core cultural resource goal of the wetland and creek restoration at Big Lagoon is to incorporate cultural heritage values and sites of the Coast Miwok into the restoration design, visitor experience, and long term management of the project area. Research has demonstrated that Coast Miwok people have lived around the lower reaches and mouth of the Redwood Creek as long as the estuary

itself. The practices of daily life and subsistence resulted in a selective process that formed part of the ecology of the locale. Retrieving and using part of this cultural ecology will be sought for the design, management, and interpretation of the ecological restoration of the Big Lagoon area.

A traditional ecological knowledge study will be prepared in consultation with the Federated Indians of Graton Rancheria to compile and analyze the archeological, ethnographic, and ethnohistoric data available to provide cultural ecological data to the restoration design. The study will consider relevant information from the Central California ethnographic region.

Removal of the Lower End of Existing Parking Lot and Picnic Area

All restoration alternatives incorporate the removal of at least the southeast end of the existing parking lot, including the picnic area, to improve hydraulic conveyance of the creek. At least 90 feet of the length of the parking lot and picnic area combined would be removed, because hydraulic models show it is the lower end of the parking lot and picnic area that causes almost all of the impact to creek flows in its current configuration. Public Access Alternatives evaluate a range of options for the new parking lot and picnic area design.

Mosquito Management

All action alternatives and the No Action Alternative contain habitat features that could support mosquito breeding. Information would be provided to visitors and residents on how to reduce exposure to mosquitoes (e.g., wearing long-sleeved shirts). Monitoring for larval mosquitoes will occur when surface water is present. Should numbers be present at levels sufficient to pose public health risks, the Park's IPM coordinator will treat the ponded areas with a biological control agent (*Bacillus thuringensis*), which is commonly used and does not impact other aquatic life. In the long term, colonization of the created wetland habitat by predatory insects should also assist with reducing the risk posed by mosquitoes.

Public Access Activities Common to All Action Alternatives

Like the three restoration approaches, the six public access approaches are guided by the same set of goals and objectives, and would have several activities in common with one another. These common activities are described in the following sections.

Location of Visitor Facilities at the Beach

Each action alternative would involve the removal of at least the southeast end of the existing parking lot, including the 7,375–square foot picnic area. NPS has previously removed approximately 2–3 feet of fill from 4,275 square feet of the picnic area, and the remainder of the picnic area would be subjected to similar excavation to restore natural floodplain elevations throughout this location. Consequently, all of the parking lot options would be set back at least 90 feet

from the existing east boundary of the lot to allow added flow conveyance during storms (Philip Williams & Associates et al. 2004).

The existing picnic area and restroom facilities at the east edge of the parking lot would be relocated to the west, remaining adjacent to the new parking lot or drop-off area. The relocated picnic area will be constructed adjacent to the parking lot to provide a visitor resource that is compatible with a natural area. The size of the picnic area will be large enough to accommodate about 10 picnic tables, with sufficient room for school groups, hiking groups and others that often gather in the area. It is expected to be between about 3,500 and 5,500 square feet.

The picnic area will be located at a distance from the local residences to minimize noise and other disturbance. However, since trash cans must be easily accessible to vehicles operated by maintenance personnel, the picnic area will be linked to the parking lot. Grills will be provided to encourage visitors to use safe practices for outdoor cooking.

The existing portable chemical toilets will be removed and replaced with new restroom facilities, such as vault toilets, which are housed in a permanent structure and are designed and maintained so that the interior is odor free. The new accessible toilets will be constructed in a location that minimizes impacts to visual, natural and cultural resources as well as potential impacts to adjacent residences and other visitor uses.

A conceptual layout or design for the picnic area has not been prepared for this Final EIS/EIR, but it will follow all requirements for ADA accessibility, including ADA-accessible picnic tables. The picnic area will be constructed on a fill pad to provide an area that will not be too wet for use throughout much of the year, but any fill placed or relocated for this purpose will be designed to avoid creating a hydraulic obstruction. Designs will factor in features that may increase privacy from adjacent cars and wind protection.

Pedestrian Access from Hwy 1

Each action alternative would include a pedestrian trail along Pacific Way from Hwy 1 to the beach parking lot/drop-off. The trail would be about 5 feet wide, except along the new Pacific Way Bridge where it would widen to 6~~8~~ feet. Portions of the trail between the bridge and the parking lot/drop-off would be built on fill newly placed over the edge of the existing creek channel. Most of the existing Monterey pines that line the east side of Pacific Way would remain, continuing to provide fall roosting sites for monarch butterflies and preventing unauthorized use of the trail for parking, although two pines would be removed for a new entry to Public Access Alternative B4, and the existing pine that is at the corner of Pacific Way and Hwy 1 may need to be removed to provide for the pedestrian trail. The new trail between the bridge and the parking lot would be separated from the road by a 5 foot–wide buffer, and could also be grade-separated from the road by approximately 1 foot. From the bridge to Hwy 1, the trail would be adjacent to the road and would be incorporated into the embankment of the newly raised portions of Pacific Way. The surface, width and slopes of the trail will meet ADA standards newly adopted by NPS in 2006.

Pedestrian Access to Beach

Under all action alternatives, a pedestrian boardwalk and bridge crossing of Redwood Creek would extend from the new parking lot to the beach. The exact locations of the boardwalk and bridge have not been determined at this time; final location and design characteristics would be defined in project design with a performance standard of minimizing adverse impacts to channel form, hydraulic processes, habitat and providing a quality visitor experience.

For the purposes of illustrating the boardwalk and bridge, each Public Access Alternative shows one of two options for location. The two options presented represent the limits within which the boardwalk and bridge would be located. The first option shown is a boardwalk originating from the parking lot/drop-off and extending seaward across the wetland and tidal lagoon. The second option shown is a boardwalk originating from the parking lot/drop-off and extending in the direction of the existing pedestrian footbridge over the creek. Under the second option, visitors would continue through the dunes to reach the beach.

Interpretive Displays

All of the action alternatives would include interpretive displays located at the southeast corner of the parking lot or drop-off, adjacent to the picnic area and restroom facilities; and at the confluence of the Coastal Trail and Green Gulch Trail. Public Access Alternative C would include an additional interpretive display at the Alder Grove parking lot.

In addition, under all alternatives, an interpretive blind/overlook for bird watching could be constructed. The location would vary, depending on the alternative. The location for blinds or overlooks would be placed to minimize the potential for adverse impacts.

New Emergency Access Route

Each action alternative includes an emergency access route from Pacific Way along the current access road to Green Gulch Farm to the southern project boundary. This route would replace the levee road for emergency access to the Coastal Trail and Coyote Ridge. The existing trail at this location was originally built to be 12 feet wide, but vegetation has encroached on both sides of the trail so that it is currently only functioning at about 6 feet wide. Under each action alternative, the encroaching vegetation would be removed and minor recontouring would be conducted at the toe of the slope to convert the trail into a functional 12 foot–wide unpaved road. The road would be outsloped to a 1% grade to improve drainage in areas with minor drainage problems. Only small quantities of fill would be used to develop the road, which would remain unpaved. An area large enough for about three vehicles to pull in side-by-side would be constructed as a turnaround or staging area for emergency vehicles at approximately the current location of the intersection of the levee road and the Coastal Trail. A bridge crossing at the southern end of the Green Gulch pasture would be improved to facilitate vehicle passage. A new padlocked gate on the access road near Pacific Way would prevent visitors from driving down the road. However, the road would still be accessible to Green Gulch Farm, which would use it to travel to and from the Golden Gate Dairy.

Interpretation During Construction

Under all alternatives, interpretive facilities would be provided to allow for increased education and public awareness regarding the project activities. These would consist of interpretive signage and possible kiosks located at strategic locations frequented by visitors, adjacent to the restoration, public access, and fill disposal activities.

Restoration Alternatives

The following sections describe the three alternative restoration approaches identified as feasible for the Big Lagoon site. As discussed above (see *Restoration Activities Common to All Action Alternatives*), all of the Restoration Alternatives would have key elements in common; accordingly, this discussion focuses on differences in scope and priorities between the alternatives. The following discussion is intended to provide a general overview of the alternatives. More detail regarding the hydraulic modeling for restoration alternatives is provided in Section 4.3.1.1, *Watershed Processes*, of Chapter 4. More specific information regarding each alternative, including the basis for design, is provided in the Feasibility Analysis Report (Philip Williams & Associates et al. 2004).

The project planning horizon is 50 years. Under all of the Restoration Alternatives, conditions at the Big Lagoon site are expected to change substantially over the 50 years following restoration, as natural geomorphic, hydrologic, and successional processes operate. Consequently, the alternatives are described both in terms of the time period immediately following restoration (Year 5) and at Year 50.

Alternative 2—Creek Restoration (Preferred)

Alternative Characteristics

Alternative 2 (Figures 2-3 through 2-5) would involve relocating approximately 2,500~~2,000~~ linear feet of Redwood Creek to the topographically lowest portion of the valley, while maintaining a habitat mix similar to current conditions. Creek relocation and restoration would be designed and graded to remove existing hydraulic constraints and minimize the need for ongoing maintenance. The new channel would include low sloping banks slightly higher than the adjacent floodplain to simulate the natural depositional levees that would occur in this reach. These low berms upstream of Pacific Way would accommodate bankfull flows, maintain the low flow channel, and support riparian vegetation, thus increasing sediment transport and channel sustainability. Downstream of Pacific Way, the lower 400 linear feet of channel would be designed to accommodate more frequent out-of-bank flows of at least a 1-year frequency to create frequent floodplain habitat for salmonids. The Alternative 2 design proposed in this report incorporates modifications to the Alternative 2 analyzed in the Feasibility

Analysis Report (Philip Williams & Associates 2004) to provide better winter rearing habitat for salmonids.

The new channel would begin near the upstream project boundary, traverse the alder grove upstream of Pacific Way and Green Gulch pasture, and rejoin the existing creek channel near the downstream end of the existing borrow channel near the current parking lot. Upstream of Pacific Way, the channel would be approximately 5 feet deep and 30 to 35 feet wide and would be sized to convey bankfull flow of about 560 to 800 cubic feet per second (cfs), estimated by the 1.5 to 2-year return period. Downstream of Pacific Way, the channel dimensions may be reduced to convey approximately a 1-year flow of about ~~300~~ 250-300 cfs to increase the frequency of out-of-bank flows, thereby providing annual winter refugia and floodplain feeding ground for salmonids. The low sloping berms on the banks of the channel downstream of Pacific Way are not necessary to convey bankfull flows but to help ensure channel definition that could otherwise be lost to cattail invasion; berms either would not be constructed or would be discontinuous in the lower 400 linear feet of this reach. Most of the existing primary channel of Redwood Creek upstream of Pacific Way would be not be filled to retain its function as backwater habitat for salmonids. At least two connections to the mainstem channel would be constructed in this reach. Two reaches of the channel downstream of Pacific Way, one near the parking lot and the other in the lowest portion of the pilot channel downstream of the pedestrian bridge, would also remain unfilled and connected to the new channel to provide backwater habitat. In the case of the pilot channel downstream of the pedestrian bridge, it is possible that no channel realignment would be necessary, and this portion of the channel would continue to serve as the mainstem rather than backwater habitat. An existing secondary channel near the levee road would also be retained to function as a backwater channel. This backwater channel would be lengthened to the northwest along the current route of the levee road. The area adjacent to this backwater ~~will~~ may be graded to an elevation slightly deeper than the existing grade to expand available floodplain habitat during base and peak winter flows. In addition, the parking lot and picnic area to be removed may be graded to allow annual winter overbank flow, although those grades were not included in the hydraulic analysis.

The Redwood Creek tributaries from Green Gulch would have their concrete lining removed and would join Redwood Creek in approximately the same location as the existing culvert connections, to minimize disturbance to existing wetlands. Also, because Redwood Creek modifications are expected to lower groundwater levels, two areas would be excavated to create emergent wetland habitat. One emergent wetland area would be in the upper pasture, and the other emergent wetland area would be at the downstream end of the Green Gulch tributaries, and outside the boundaries of existing cattail habitat. The excavated wetland areas would have gradual slopes to provide suitable habitat conditions for the CRLF under the expected range of groundwater levels. The two tributaries from Green Gulch would be realigned and allowed to dissipate into the newly excavated wetland, mirroring historic conditions in which the Green Gulch drainage was not connected to the main channel. Concrete lining in the southern-most Green Gulch drainage channel would be removed.

The existing wetland areas at the southern corner of the pasture would be left undisturbed to minimize potential for disturbance of CRLF. During the detailed design phase, the exact location of wetland excavation, Green Gulch tributaries and Redwood Creek confluence would be refined to minimize impacts to wetland vegetation that supports CRLF.

Ecological Restoration Features

Under Alternative 2, much of the site is expected to evolve from degraded wetlands to mature riparian wetland forest due to lowering of the groundwater table in the Green Gulch pasture, which results from a more natural channel depth. The site would be graded to promote establishment and maintenance of approximately twice the existing acreage of riparian wetland vegetation, with a decrease in seasonal wetland acreage in the Green Gulch pasture area compared to the No Action Alternative. The narrow size of the creek channel downstream of Pacific Way would mimic natural systems that often lose capacity towards their mouths, and would increase the frequency of floodplain inundation without adding to the risk of a channel avulsion before the riparian corridor is established.

During the early phases of this alternative (approximately Year 5), it is expected that the new riparian wetland vegetation would have established, but would not have matured sufficiently to produce significant shading of the creek channel, or offer high-quality habitat for nesting riparian birds. By Year 50, the new riparian areas downstream of Pacific Way would have matured, providing many ecological functions such as stream shading, sources of LWD and leaf litter input to the aquatic ecosystem, and habitat for various terrestrial riparian wildlife species. Emergent marsh habitat in Green Gulch pasture would be lost due to sediment deposition. Some refinements to the marsh during its design could slow the rate of sediment deposition there.

Alternative 3—Creek and Small Lagoon Restoration

Alternative Characteristics

Alternative 3 (Figures 2-6 through 2-8) seeks to combine riparian restoration components with restoration of open water and wetland habitats. As with Alternative 2, Redwood Creek would be realigned from near the upstream project boundary, through Green Gulch pasture, to the existing creek channel near the downstream end of the existing borrow channel. However, unlike Alternative 2, Alternative 3 would include the creation of two open-water lagoons, one on either side of the new channel. The two small lagoons would be backwaters, connected to the creek near the downstream end of each lagoon.

The banks of the lagoons would have varied slopes to favor a variety of habitats. In general, the lagoon to the west of the new channel would have steeper banks to encourage riparian vegetation and the lagoon to the east would have gentle slopes to promote wetland vegetation. The lagoon to the west would be excavated to connect to the borrow ditch channel, while preserving existing riparian vegetation on the west creek bank to the extent possible. The lagoons would maintain a minimum water depth of 3–4 feet year-round.

Ecological Restoration Features

Alternative 3 would initially restore a small lagoon system consisting of both open water and emergent wetlands; of all the alternatives, Alternative 3 would provide the most emergent wetlands that would be sustained over time through natural infilling of the two small lagoons. As described for Alternative 2, a small initial loss of existing riparian habitat just downstream of Pacific Way would occur to accommodate the new creek channel. Also, as with Alternative 2, the brackish marsh area between the existing parking lot and tidal lagoon would disappear by Year 50 due to natural sand deposits, providing an area for additional dune evolution.

Alternative 3 would provide the largest increase of off-channel winter rearing habitat for coho salmon and steelhead of all the alternatives. However, this condition would be temporary, and over the 50-year planning horizon, the two small lagoons would be expected to fill in with 3–4 feet of sediment, replacing much of the open water habitat with emergent wetland. By Year 50, the landscape is expected to evolve to be similar to Alternative 2 at Year 0, including a persistent backwater channel along the western bank of the western small lagoon, but with more shallow wetlands in the filled lagoon areas.

Alternative 4—Large Lagoon Restoration

Alternative Characteristics

Alternative 4 (Figures 2-9 through 2-11) would create a periodically brackish open-water habitat similar to historic (1853) conditions, modified to reflect existing constraints of Pacific Way and private property. This alternative would involve the creation of a large lagoon with fringing wetlands extending to the edge of the valley immediately landward of Muir Beach. As with Alternatives 2 and 3, Redwood Creek would be realigned from near the upstream project boundary to approximately 225 feet south of Pacific Way, where the lagoon would begin. The seasonally brackish lagoon would approximate the configuration of the historic Big Lagoon, except that it would be constructed with 100-foot minimum setbacks from existing constraints such as the modified parking lot footprint, Pacific Way, and upland areas of Green Gulch pasture. Consequently, the restored lagoon would be slightly smaller than the historic Big Lagoon.

The lagoon would be excavated with gentle side slopes to encourage colonization of emergent wetland vegetation. Like the small lagoons under Alternative 3, the large lagoon would maintain a minimum water depth of 3–4 feet year-round.

Ecological Restoration Features

Alternative 4 would initially create a large lagoon system comprised of open water fringed by emergent wetlands. The removal of hydraulic constraints and the relatively larger excavation of sediment would provide the greatest opportunity of all the alternatives for the system to evolve on its own in a state of equilibrium. By Year 50, it is expected that roughly half of the lagoon would be

filled, forming a delta at the mouth of the creek and raising the bottom elevation by roughly 2 feet.

At Year 5, the large lagoon under Alternative 4 would provide more open water habitat and more salmonid rearing habitat than other alternatives. By Year 50, the riparian areas around the Redwood Creek channel would have matured, providing a contiguous riparian corridor until the creek empties into the lagoon. Periodic saltwater intrusion into the lagoon would allow for some brackish marsh plant species to persist along the lagoon fringes.

Table 2-2a shows the acreages of various habitat types at Years 5 and 50 under the action alternatives, with the No Action Alternative presented for comparison. Table 2-2b shows the extent of change in riparian habitat under the various Public Access Alternatives, and Table 2-2c shows the extent of change in riparian habitat under the various Bridge Alternatives compared to existing conditions. Note that these acreages are approximate; due to dynamic conditions at the site, actual acreages may vary from those presented here, particularly at Year 50.

Table 2-2a. Projected Approximate Acreage of Habitat Types for Each Restoration Alternative at Year 5 and Year 50

	Restoration Alternatives at Year 5 (Approximate Acres)				Restoration Alternatives at Year 50 (Approximate Acres)			
Habitat Type	1	2	3	4	1	2	3	4
Open Water	2.4	3.8	6.7	11.6	2.4	2.7	2.6	7.0
Emergent Wetland	13.3	3.4	4.7	4.7	13.3	2.8	8.2	5.1
New Riparian Wetland	0.0	10.6	6.0	4.2	0.0	0.0	0.0	0.0
Mature Riparian Wetland	13.2	10.5	10.9	7.8	13.2	21.6	16.3	15
Dune Habitat	0.1	0.7	0.7	0.7	0.1	2.1	2.1	2.1

Note: Acreage calculations assume existing parking lot and bridge/roadway.

Table 2-2b. Projected Approximate Change in Riparian Wetland Extent Relative to Existing Conditions for Each Public Access Alternative at Year 5 and Year 50

Change in Riparian Wetland Extent for Public Access Alternatives (Approximate Acres)					
B1	B2	B3	B4	B5	C
Change in **New** Riparian Habitat Areas at **Year 5**					
0.90	0.32	0.40	0.90	0.32	0.97
Change in **Mature** Riparian Habitat Areas at **Year 5**					
-0.15	-0.15	-0.65	-1.18 ~~-1.24~~	-1.03	-1.18
Change in **Mature** Riparian Habitat Areas at **Year 50**					
0.75	0.17	-0.25	-0.28 ~~-0.34~~	-0.71	-0.21

Table 2-2c. Projected Approximate Change in Riparian Wetland Extent Relative to Existing Conditions for Each Bridge Alternative

Change in Riparian Extent for Bridge Alternatives (Approximate Acres)			
BR1	BR2	BR3	BR4
-0.32	-0.12	-0.30	-0.28

Predictions of site conditions at Year 50 were based on projected future sediment delivery rates and deposition patterns at the site. Predicting geomorphic changes over a 50-year time scale requires a number of simplifying assumptions and is subject to considerable uncertainties, especially in a system like Redwood Creek where there is a short record of actual sediment transport measurements. Annual sediment delivery rates were based on Stillwater (2004); however, given the various uncertainties, a reasonable estimate of error is likely in the range of plus or minus 25–50%. In other words, the 50-year site condition shown in this Final EIS/EIR may actually occur substantially before or after Year 50. The degree to which altered assumptions affect the rate of site evolution would vary by alternative.

In addition, sediment delivery is expected to be episodic, because sporadic or intermittent events such as fire, El Niño patterns, and large storms will probably play the dominant role in shaping site geomorphology. Such events could cause responses such as channel avulsion or other important geomorphic changes at the site; however, because of the uncertainty surrounding such events, average sediment inputs were assumed. Moreover, all of the Restoration Alternatives will be designed to take advantage of the natural geomorphic processes that shape site evolution, and because they each focus on returning stable conditions at the site, substantial deviations from the projections given here are considered unlikely. For instance, because the realigned stream channel upstream of Pacific Way

would be located at the low point of the valley, the potential for the channel to avulse is considered low.

Table 2-3 shows a sensitivity analysis of the longevity of the alternatives given changed assumptions regarding average sediment delivery rates, episodic events, and trapping efficiency. The table identifies the year in which Year 50 conditions would be realized based on changed assumptions. Note that a given set of changed assumptions affect project lifetime of each restoration alternative to the same extent.

For example, if average sediment delivery assumptions were reduced to reflect pre-1840 conditions, sedimentation of the site would be slowed such that the Year 50 condition as depicted in the project figures would not occur until Year 229. Similarly, assuming that wet years only occur 5% of the years reduces sediment delivery assumptions such that the Year 50 condition would not occur until Year 54. In summary, changing the assumptions regarding sediment delivery to, and trapping efficiency at, the site results in changed predictions regarding rates of sedimentation and hence future site conditions, or more specifically, the period of time that would elapse before the conditions as depicted on the Year 50 drawings would actually occur.

Table 2-3. Project Lifetime Under Various Scenarios

Scenario	Project Lifetime (years)
Baseline Scenario[1]	50
Average Sediment Delivery Volume[2]	
Pre-1840 conditions	229
1841–1920 conditions	26
1921–1980 conditions	24
1981–2002 conditions	44
Episodic Sediment Delivery Frequency – Frequency of Wet Years[3]	
Low (1 per 20 years)	54
1920–1970 conditions (1 per decade)	45
1970–2000 conditions (2 per decade)	33
High (3 per decade)	26
Trapping Efficiency Assumptions	
120% of Baseline Scenario	42
80% of Baseline Scenario	63

Notes:

1 From Philip Williams & Associates et al. 2004.

2 Used sediment delivery rates from Stillwater (2004).

3 Used sediment yield for low flow, average and high flow years from Table 27 of Stillwater (2004), attenuated to match future sediment delivery rate predictions from Stillwater (2004). Assumed average and low flow years were evenly split. Project lifetime likely biased downwards as a result of use of water year 1982 as representative wet year.

Public Access Alternatives

The following sections describe the six Public Access Alternatives identified as feasible for the Big Lagoon site. As discussed above (see *Restoration Activities Common to All Action Alternatives*), all of the Public Access Alternatives would have key elements in common; accordingly, this discussion focuses on differences in scope and priorities between the alternatives. The boundaries of all parking lot alternatives were drawn within an area defined through the use of a hydraulic model to avoid impacts to creek flow conveyance and upstream flooding during high flows. Hydraulic models showed that flows in the creek, in its current alignment and confined state, impact almost the entire lower end of the parking lot and picnic area.

Under Public Access Alternatives B1 through B5, the parking lot would remain at the beach in generally the same area as the existing lot. All visitors would arrive at the beach parking lot and have direct access to the beach along a boardwalk.

Under Public Access Alternative C, the existing parking lot at the beach would be removed and a new lot would be constructed at Alder Grove. Only parking for persons with disabilities and a drop-off/turnaround would be located at the beach under this alternative.

Public transit pull-offs or turnarounds are not proposed as part of this project. They are shown in figures for informational purposes only; they were considered at one time under the Comprehensive Transportation Management Plan (CTMP) for Parklands in Southern Marin, which is no longer active. However, other County plans are underway to improve public transit pull-offs on Hwy 1. The only exception is Public Access Alternative C, which would include a drop-off/turnaround.

Under all of the Public Access Alternatives, the parking lots would be configured to include dense native tree cover and/or native herbaceous vegetation in 5–foot wide planting bays, or swales, between the rows of parking and in planting islands separating groups of vehicles. The parking lot would be unpaved under all alternatives.

Note that the figures depicting the Public Access Alternatives (Figures 2-12 through 2-17) show each matched with a restoration alternative; however, the Public Access Alternatives could be matched with other restoration alternatives as shown on Table 2-1.

Alternative A—No Action, 175 Cars at Beach

Under the No Action alternative, the parking lot would retain is 175-car capacity and current configuration, without vegetated drainage swales. The existing parking lot is 63,000 square feet.

Alternative B1—50 Cars at Beach

Public Access Alternative B1 would construct a 50-space parking lot at the beach at the site of the existing parking lot (Figure 2-12). The parking lot would have an area of 23,510 square feet.

Alternative B2—145 Cars at Beach

The 49,175-square foot parking lot under Public Access Alternative B2 would be similar in configuration to Alternative B1, but would extend further eastward to

accommodate a maximum of 145 vehicles (Figure 2-13). Only the lower 90 feet of the existing parking lot and picnic area would be removed, in order to allow improved creek flow conveyance. If a drop-off/turnaround were added to this area in the future, it would eliminate about 30 of the 145 parking spaces in the lot.

Alternative B3—175 Cars at Beach

Public Access Alternative B3 would accommodate a maximum of 175 vehicles, the same number as the existing parking lot. As shown in Figure 2-14, the lot would be similar in shape and extent to the lot under Alternative B2, but would extend further northward into existing riparian habitat and would be somewhat further from the creek. At 62,200 square feet, the lot would be about the same size as the existing parking lot. In addition to the lower parking lot and picnic area that would be removed under all Restoration Alternatives, additional area of the existing parking lot would be removed. The added length of the lot to be removed ranges from 16 feet at the northeast end of the lot to 40 feet at the southeast end of the lot. The distance of the parking lot from the creek bank in the vicinity of the parking lot would be about 180 feet at a minimum up to a maximum of 240 feet.

Alternative B4—175 Cars Rotated Parallel to Pacific Way (Preferred)

The parking lot under Public Access Alternative B4 would have the same 175-car capacity as Alternative B3, but would be rotated parallel to Pacific Way (Figure 2-15). This 71,445-square foot lot would include a new turn-off from Pacific Way and would include 310 linear feet of stacking room for cars between the entrance and the first parking stall. This alternative would involve removal of two to three Monterey pines along Pacific Way where the new entrance to the parking lot would be built. The distance of the parking lot from the creek bank would be about 350 feet.

Alternative B5—200 Cars at Beach

Public Access Alternative B5 proposes the largest parking lot of all the alternatives, at 87,418 square feet and a maximum of 200 vehicle spaces. As shown in Figure 2-16, the parking lot would be located in the same area as Alternatives B1 through B4.

Alternative C—118 Cars at Alder Grove plus 14 Parking Spaces for Disabled and Drop-off at Beach

Under Public Access Alternative C, a new parking lot would be constructed at Alder Grove along Hwy 1, north of Pacific Way (Figure 2-17). This parking lot would have an area of 41,800 square feet and would accommodate a maximum of 118 vehicles. Pedestrians would walk the 0.5 mile from the lot to the beach on a new trail through the alder grove that would be developed as part of this alternative. Additionally, a 20,805–square foot area on the footprint of the existing parking lot at the beach would accommodate 14 parking spaces for persons with disabilities and a drop-off/turnaround. This alternative would require relocation of several utility poles located near the new parking lot on Hwy 1 to allow a sufficient line-of-sight for vehicles entering and exiting the lot. The parking lot would be generally visible from Hwy 1 through a 25-foot deep screen of trees. In addition, a boardwalk along the eastern edge of the lagoon could be constructed under this alternative.

Bridge Alternatives

The Bridge Alternatives are shown on Figures 2-18 through 2-22, and described on Table 2-4 and in the text below. It should be noted that changes were made to Bridge Alternative BR4 between the Draft and Final EIS/EIR. These changes are discussed below. Although all action alternatives are analyzed to assume a maximum deck width of up to 32~~36~~ feet, including 6~~8~~ feet for a pedestrian path, it is expected that designs will incorporate a somewhat narrower deck width. They would all be centered on the new creek alignment and would span the floodplain. The bridge replacement would involve removal of many trees that line Pacific Way to allow clearance for construction.

The analysis of the road approaches assumes a slightly wider road than the existing road—25 rather than 20 feet Three alternatives include a raised road at either end of the new bridge. Assuming a 25 foot–wide road, with 3:1 side slopes, resulting in a total footprint of approximately 40–50 feet, the length of the raised approaches and the total footprint of the road embankment varies by alternatives, as shown in Figures 2-19 through 2-21.

Table 2-4. Bridge Alternative Characteristics

Bridge Alternative	Bridge Deck Height (feet NGVD)	Bridge Span (feet)	Road Elevation (feet NGVD)	Estimated Fill Volume to Raise Road (cubic yards)
BR0 (No Action)	15.2	24	~11 to 15.2	n/a
BR1	16.5	50	15.5 to 16.5	2,000
BR2	15.0	50	~11 to 15	400
BR3	16.25	150	15.5 to 16.25	1,000
BR4	~16.25 to 18.0	250~~266 to 300~~	~15 to 18	1,110

All alternatives would be designed to be aesthetically compatible with site character, meet Marin County's bridge standards, include an ADA accessible pedestrian path on the downstream side, and contain rails that minimize blockage of infrequent high stream flows which could overtop the bridge deck. While detailed bridge designs have not been developed to date, all Bridge Alternatives would be designed to be as visually unobtrusive as possible, and be of a design and color that is compatible with the surrounding landscape character.

Alternative BR0—No Project

Under the No Project Alternative, the existing bridge would remain. The existing bridge has an approximately 24-foot span with a deck elevation of 15.2 feet NGVD.

Alternative BR1—50 Foot–Long Bridge with a Raised Road

The short bridge spans the new 35 foot–wide channel with a deck at 16.5 feet NGVD. To gain access to the deck, the elevation of the north and south approaches would be raised by as much as five feet to 15.5 feet NGVD. This grading would include elevation changes on the northeastern side to integrate with the grades of the new emergency access road. Due to the limited height, this bridge is designed to account for overtopping during severe flood events, yet to remain passable during routine events. The bridge would be free-span and would not need supporting piers.

Alternative BR2—50 Foot–Long Bridge with a Low Road

Similar to Alternative 1, this short bridge spans the 35 foot–wide channel. The deck height, however, is lower at approximately 15 feet NGVD (similar to the existing bridge) and would not require extensive elevation changes for the

approach. The approaches would range from 11 to 15 feet NGVD. The bridge would be free-span and would not need supporting piers.

Alternative BR3—150 Foot–Long Bridge with Raised Road

This bridge would be longer than Alternatives BR1 and BR2 and would both span the new 35 foot–wide channel and areas of riparian habitat and flood plain on either side of the channel. The bridge span would provide for the same available floodplain passage as the existing condition, which is currently defined by the area between the Pelican Inn fill pad and a fill pad for AT&T utility boxes, which together eliminate about 200 feet of floodplain width. For the purposes of this analysis, it is assumed that 2 foot–wide piers, placed at approximately 40-foot intervals, would be used to support the span and allow for channel migration. The bridge height would be about 16.25 NGVD, compared to the elevation of Hwy 1 at about 16.5 NGVD. Piers would not be placed in the active channel. Grading would tie into the approach from Hwy 1 and to the new emergency access road. Grade changes would begin at Hwy 1 and increase closer to the bridge. The ramp to the new bridge would begin just south of the entrance to the Pelican Inn.

Alternative BR4—250 (reduced from 266 to 300 feet) Foot–Long Bridge with Highest Road (Preferred)

This alternative would be the longest bridge, and would span the entire riparian zone and floodplain from the Pelican Inn on the north to the existing bridge on the south. This bridge would have the highest deck of all the alternatives, between 16.25 and 18 feet NGVD, compared to the elevation of Hwy 1 at about 16.5 feet NGVD (exact bridge height to be determined during the design phase based on design constraints). Based on conceptual design conducted as part of this Final EIS/EIR, Bridge Alternative BR4 has been slightly reduced in length compared with the alternatives described in the Draft EIS/EIR, from 266–300 feet to 250 feet. For purposes of analysis, as in Alternative BR3, two foot–wide piers, placed at approximately 40-foot intervals, would be used to support the span. To allow for channel migration, piers would not be placed in the active channel.

Fill Disposal Alternatives

The Restoration and Public Access Alternatives would generate various amounts of fill as a result of excavation during restoration and construction, as shown in Tables 2-5 and 2-6. The Fill Disposal Alternatives address the issue of how to reuse and/or dispose of the generated fill.

Under all alternatives, fill would be reused on-site where needed for project actions, thereby reducing the need for off-site use or disposal. However, some

off-site disposal would still be necessary, and several alternative locations for fill disposal have been considered. These locations include an unused reservoir pit on NPS property north of the site, near Hwy 1 (the “Unused Reservoir Pit”); a flat field on NPS property known as Upper Banducci Field, and the former Hamilton Air Force Base in Novato. In addition, three other sites have been identified as possible fill disposal locations; these sites are analyzed programmatically in this Final EIS/EIR; if they are selected at a later date, further NEPA analysis would be required. All of the fill disposal sites are summarized in Table 2-7, and further described in the sections that follow. The three fill disposal sites analyzed at a project level in this Final EIS/EIR are also shown in Figure 2-23. Note that where a single fill disposal alternative would not accommodate the entire quantity of fill generated by a given set of restoration and Public Access Alternatives, a combination of Fill Disposal Alternatives could be implemented. It is also important to note that while the proposed Bridge Alternatives may require fill for buttresses and approaches, it is assumed that due to the engineered nature of such fill, it would need to be imported from off-site, and that reuse of on-site materials would not be possible for this purpose.

Table 2-5. Summary of Excavation and Fill Quantities for Restoration Alternatives

	Restoration Alternatives (all units in cubic yards)		
	Alternative 2	Alternative 3	Alternative 4
Excavation Items			
New Main Channel			
a) Upstream of Pacific Way	2,700	2,000	2,000
b) Downstream of Pacific Way	4,400	3,200	600
c) Downstream of Footbridge	1,500	1,600	1,600
New Green Gulch tributaries	100	0	0
Backwater Channel[1]	5,000	0	0
Wetlands Excavation[2]	11,000	0	0
Lagoon Excavation(s)	0	101,100[3]	172,200
Remove Levee Road	2,500	2,500	2,500
Expand Backbeach Lagoon[4]	3,000	3,000	3,000
Remove Lower Parking Lot and Picnic Area	1000	1000	1000
Total Excavation[6]	**31,200**	**114,400**	**183,000**
Fill Items (Not including Parking Lot)			
New Creek Berms	1,800	800	400
Fill Existing Main Channel	2,000	2,500	2,500
Fill Existing Green Gulch tributaries	600	0	0
Trails & Emergency Staging Area[5]	1,400	1,400	1,400
Total Fill	**4,800**	**4,700**	**4,300**
Net Excess Material	**26,400**	**109,700**	**178,600**

Notes:

1 Includes extension of existing backwater channel and deepening the former main channel.

2 Excavation of wetland areas for Restoration Alternatives 3 and 4 are included under Lagoon Excavation.

3 Based on 30,800 and 70,300 cubic yards excavation for the west and east lagoons, respectively.

4 Includes excavation of existing tidal lagoon (approximately 200 feet by 100 ft width, 4 feet deep). Assumes that Kikuyu grass removed near the tidal lagoon will be composted and therefore is not included in earthwork balance estimates.

5 Estimated fill volume for approximately 1,200-foot long trail. Actual trail length will vary depending on the Public Access Alternative.

6 It is possible that some excavation quantities shown could be substituted for grading that would help achieve annual floodplain inundation for salmonid winter habitat.

Table 2-6. Summary of Excavation and Fill Quantities for Parking Lot Alternatives

	Cubic Yards		
Public Access Alternative	Excavation Volume	Fill Volume	Net Excess Material
A—No Action	0	0	0
B1—50 Cars at Beach	3,500	700	2,800
B2—145 Cars at Beach	0	700	(700)
B3—175 Cars at Beach	600	2,700	(2,100)
B4—175 Cars Rotated Parallel to Pacific Way	2,900	5,700	(2,800)
B5—200 Cars at Beach	0	8,600	(8,600)
C—118 Cars at Alder Grove plus 14 Spaces for Disabled and Drop-Off at Beach	3,800	7,000	(3,200)

Table 2-7. Summary of Fill Disposal Options

	Fill Disposal Site				
	Sites Analyzed in Detail in this Final EIS/EIR			Sites Analyzed Programmatically in this Final EIS/EIR	
	Unused Reservoir Pit	Upper Banducci Field	Hamilton Air Force Base Wetlands	Dias Ridge Trail	Coastal Trail South of Site
Disposal Capacity (cubic yards)	23,800	4,000	178,000	24,000~~4,000~~	4,000
Stockpile Capacity (cubic yards)	NA	8,500	NA	NA	NA
Total Capacity (cubic yards)	23,800	12,500	178,000	24,000~~4,000~~	4,000
Approximate Total Truck Trips for Full Capacity	1,800	950	13,400	1,800~~300~~	1,200
Haul Distance (miles)	0.75	0.5	20	2.5	0.75

Fill Disposal Sites Analyzed in Detail in This Final EIS/EIR

Unused Reservoir Pit

An unused reservoir on NPS property north of the site, near Hwy 1, known as the "Unused Reservoir Pit," is approximately 204 feet long, 175 feet wide, with an average depth of 15 feet, and a storage capacity of about 23,800 cubic yards of material. The pit is in a stable location on the hilltop adjacent to the portion of the Coastal Trail north of the Muir Beach overlook. Any type of soil or weedy material could be placed safely in the reservoir for disposal without concerns of sediment run-off. The surface layer would be capped with rocky material and

several inches of fine soil to promote revegetation by native shrubs, particularly coyote brush.

The reservoir was constructed by local farmer Amadeo Banducci in the late 1970s before the property was sold to NPS. It had been intended for use as a reservoir for hillside crops, but was never completed or used for that purpose.

The approximately 0.75-mile haul route to this site follows Hwy 1 north of Pacific Way, past the Muir Beach Overlook. Trucks would turn off of Hwy 1 onto the Coastal Trail to reach the reservoir. An area would be cleared near the reservoir to allow for a truck turnaround.

Upper Banducci Field

The flat field on NPS property formerly farmed by Amadeo Banducci includes an upland area dominated by non-native vegetation where vegetative material would be placed to compost. Assuming placement only in the upper portion of the field that is not wetland, and a wide buffer zone of at least 100 feet from the top of bank of Redwood Creek, the site could accommodate approximately 4,000 cubic yards of material.

In addition, the site could be used as a temporary stockpile location for material that must be removed from the project site quickly, but would not be hauled out of the watershed until a later time. With temporary stockpiles at a depth of some 5 to 6 feet, covered over winter months to prevent runoff or weed establishment, up to an additional 8,500 cubic yards of material could be accommodated at the site.

The 0.5 mile haul route to the site follows Hwy 1 north from Pacific Way to the gravel driveway adjacent to Redwood Creek and the Hwy 1 bridge. Trucks would travel down the driveway, cross an intermittent tributary that would be temporarily filled, and up the field for disposal of compost or stockpiling of fill in the upper portion of the site. The road through the field would be created by mowing a swath of vegetation; no fill would be placed other than that related to the tributary. The temporary fill in the tributary would be removed annually prior to the rainy season, and replaced in spring as needed.

Hamilton Air Force Base Wetland Restoration

USACE and the CCC are jointly conducting an extensive wetland restoration project at the former Hamilton Air Force Base in Novato, California. Due to subsidence of the former wetland, vast quantities of fill material are needed to restore the wetlands fringing San Francisco Bay. While most of the fill for the Hamilton project will be dredged material imported by barge, the project could accept large quantities of clean fill transported by truck. With the exception of weedy material, fill material of a wide range of soil textures would be acceptable for this purpose. The largest quantity of fill that could be generated by any of the three Big Lagoon project alternatives, about 191,000 cubic yards of material, could be accepted for use at the Hamilton wetland restoration project.

Potential environmental impacts or benefits of fill placement at the Hamilton wetland restoration site have been addressed by the EIS/EIR prepared for that project (Jones & Stokes 1998), and are not revisited here except for the purposes of the cumulative impact analysis. The analysis related to disposal at the Hamilton site in the current Final EIS/EIR is therefore restricted to an evaluation of hauling trips between the Big Lagoon site and Hamilton, and related environmental effects.

The approximately 20-mile haul route to this fill site follows Hwy 1 south from the site to Tam Junction in Mill Valley for approximately 7 miles, and then north on US-101 about 13 miles.

Fill Disposal Sites Analyzed Programmatically in This Final EIS/EIR

Dias Ridge Trail Recontouring

The Dias Ridge Trail is a former ranch road extending from Panoramic Highway through Tamalpais State Park lands to NPS lands to the south. The trail ends on Hwy 1 south of Muir Beach at a dangerous curve in the road where there is no road crossing or pedestrian path. The former ranch road was built on landscape contours that promote erosion. It currently has numerous gullies, thru-cuts, and head-cuts. NPS and Tamalpais State Park are currently planning a project to recontour the trail in an alignment on the landscape that will significantly reduce erosion and eliminate the erosive scars of the existing trail. Up to about 24,000~~4,000~~ cubic yards of clayey, rocky soil, such as the type of material in the levee road that will be removed, may be used to recontour the trail.

Potential environmental impacts and benefits of the trail recontouring are being addressed through separate NEPA/CEQA documentation prepared by California State Parks and NPS for the Dias Ridge Trail project, and are not discussed here except for the purposes of the cumulative impact analysis. The analysis related to disposal at the Dias Ridge site in the Final EIS/EIR is therefore restricted to an evaluation of hauling trips between the Big Lagoon site and Dias Ridge, and related environmental effects.

The 2.5-mile haul route from the Muir Beach project site to Dias Ridge follows Hwy 1 south to the intersection with Panoramic Highway (also known as “Three Corners”) and up Panoramic Highway to the turn-off onto the Dias Ridge Trail.

Coastal Trail Recontouring, South of Site

The Coastal Trail south of Muir Beach to Coyote Ridge follows a coastal route used by previous generations, but its poor alignment on hillslope contours promotes erosion. Approximately 2,500 to 4,000 cubic yards of clayey, rocky soil, such as that to be excavated for the levee road removal, could be used to recontour the trail in a sustainable alignment that would not be susceptible to continued erosion or gullying.

The haul route to this site would not require travel on public roads. Trucks would travel over the levee road or new emergency access road to the Coastal Trail intersection, then up the hill to trail recontouring locations between Muir Beach and Coyote Ridge. The total distance from the project site to Coyote Ridge is 0.74 miles.

Because the specific locations for trail recontouring have not been identified at this time, and because the Coastal Trail in this area will be the subject of a future Determination of Eligibility for listing in the National Register of Historic Places, the analysis of this site is limited and only addresses the effects of haul trips and the typical effects of trail recontouring. Should the recontouring project move forward, it would be the subject of a subsequent NEPA analysis.

Construction Scenario

As identified above, construction scenarios would be very similar under all of the restoration, Public Access and Bridge Alternatives. The following sections provide an overview that applies to all combinations of restoration and public access, with distinctions between the alternatives presented in the text.

Construction Equipment and Personnel

Construction would be completed using standard construction equipment. The main pieces of equipment to be used would likely include the following.

- Compressors/jack hammers.
- Excavators, backhoes, scrapers, water trucks, compactors.
- Front-end loaders, cranes, forklifts.
- Flat-bed delivery trucks.
- End and bottom dump trucks, ten-wheel dump trucks.
- Paving equipment.
- Concrete delivery trucks.
- Welding equipment.

The typical crew size on site at any one time would vary between 5 and 30 workers, plus supervisory personnel, inspectors, monitors, and volunteers.

Construction Footprint

Because project design has not been completed, detailed assumptions for the area disturbed by construction under each alternative are not yet available. Disturbance would include the footprint of new project features, as well as

temporary access roads, staging areas, stockpile areas, and bypass roads. Low impact methods for access roads, such as temporary placement of mats or plywood as opposed to new road grading, may be used where appropriate, although they would not be used for the Pacific Way bypass road.

Staging areas would be located in previously disturbed locations to the extent possible, including the existing parking lot and the emergency turnaround near the pedestrian bridge. The specific locations of access roads, staging areas, etc., will be identified during project design, and will be selected to minimize the potential for adverse impacts.

Construction Phasing, Schedule and Major Tasks

Detailed construction phasing will be developed as part of project design; the information presented here is intended to identify the major tasks associated with construction, as well as any constraints driving construction phasing.

Construction is anticipated to begin in about 2008 or 2009 and would take between 3 years (for Restoration Alternative 2) and 4 years (for Restoration Alternatives 3 and 4) to complete. Estimates for construction duration have assumed a normal working schedule (i.e., one 8 hour shift per day, 5 days per week). Construction would be limited to the hours between 8:00 a.m. and 5:00 p.m., Monday through Friday and 9:00 a.m. and 4:00 p.m. on Saturdays, with no construction allowed on Sundays. These estimates of construction duration would be shortened by extending the seasonal construction window.

Major construction tasks are described below; some tasks would recur each year of construction, while others would only occur once.

Pre-Implementation

Major tasks to be accomplished include plant propagation, clearing trees for construction, vegetation composting, and log acquisition for use as LWD. Geotechnical borings would be conducted in the vicinity of Pacific Way to analyze the subsurface as part of bridge design. These borings could be coordinated with further analysis of the extent of archeological resources at the site.

Site Preparation and Mobilization

Project mobilization will include setup of unpaved staging and parking areas (including clearing and grubbing), recycling of debris, installation of unpaved access and hauling roads, installation of construction interpretation and signage, equipment mobilization, installation of construction fencing and gates, installation of best management practices (BMPs) for erosion control and other aspects of resource protection, and installation of the temporary creek crossing to the Upper Banducci Field for hauling of vegetation for composting.

Parking Lot Reconfiguration

This includes removal of fill associated with the existing parking lot and picnic area, clearing and grubbing and placement of fill at the new parking lot location, and revegetation in disturbed areas and in parking lot swales.

Pacific Way Bridge Construction

This task will include construction of a temporary bypass road, including clearing and grubbing, removal of existing pavement and off-site disposal, construction of the new bridge, water line relocation, and construction of bridge approaches. After construction is complete, the temporary bypass road would be removed. It is possible that the restoration would be implemented prior to construction of the new bridge. In that scenario, the realignment of the creek in the vicinity and upstream of Pacific Way would be deferred until construction of the bridge, and a temporary channel would be constructed that connects the existing Redwood Creek channel with the downstream realigned segments.

Removal/Relocation of Utilities, Tavern Remnants, Concrete Channels, Buried Walls, and Other Features

Water, telephone and power service lines would be relocated, and existing power lines would be abandoned and removed. Power lines currently in the wetland area may be replaced with underground lines down a portion of Pacific Way, but other existing power poles along Pacific Way would remain in place. AT&T utility boxes adjacent to Pacific Way would be relocated, most likely closer to Hwy 1. Fences, gabions, tavern remnants, buried walls, and other concrete structures would be removed and disposed of.

Backbeach Lagoon Enhancement and Dune Restoration

This would include excavation to the identified depth, fill disposal, installation of LWD, and fencing of dune areas.

Creek Realignment

This will include clearing and grubbing while avoiding as many mature trees as possible, excavation of the backwater channels, main channel, tributary channels, drainage swales, and the levee road, filling of portions of abandoned channels (where applicable), LWD installation, berm construction, and revegetation.

Wetland/Lagoon Creation

This will include clearing and grubbing, excavation of the wetland/lagoon features, fill disposal, and revegetation.

Trail and Emergency Access Road Construction

This task will involve clearing, and grading, fill placement where necessary, and minor drainage improvements. A new crossing over the tributary will also be built.

Construction of Boardwalks, Interpretive Signs and Displays, Picnic Areas, Restrooms, Overlook Platforms

Features would be installed at the identified locations.

Invasive Species Removal and Revegetation

A variety of invasive species will be removed and composted off-site, either through mechanical/manual removal (e.g., Cape Ivy) or by excavation (e.g., Kikuyu grass). Revegetation will be performed using mature native vegetation and reseeding that has been propagated in advance to the maximum extent possible.

Winterization and Demobilization

Winterizing the site will include revegetation, installation of erosion control measures, removal of construction equipment as appropriate, and removal of fill from the creek leading to the Upper Banducci composting site.

Channel Commissioning

Once the new channels and other water features are complete, this task will involve flow diversion and connection with new channel, as well as fish relocation and monitoring.

Archeological, Cultural, Biological, and Other Resource Monitoring

These activities would be conducted throughout the project duration as needed.

Considerations for Construction Approach

The following considerations and constraints will drive actual construction phasing and scheduling.

Construction Season

Most construction (and particularly in channel work) would be restricted to the August 1~~15~~ –October 31 dry season. Tree removal would be conducted outside of the nesting season (after August 1st ~~15th~~). Some construction activities, such as those related to the parking lot, may be permitted to occur outside of the seasonal work window.

Coho Salmon and Steelhead Habitat

Although the dry-season timing of the construction window will prevent potential construction-related impacts to migrating Coho salmon and steelhead, construction will be phased to protect rearing juvenile Coho salmon and steelhead that may occur in the stream channels.

At present, flows in Redwood Creek are bifurcated into two channels, with the west channel being the dominant channel. For Alternatives 2 and 3, the new channel and/or small lagoons would be excavated without disturbing the existing eastern channel, leaving it intact to provide habitat for juvenile rearing. Both alternatives would require excavating a portion of the eastern channel (to connect and extend the backwater channel under Alternative 2, and the west lagoon under Alternative 3). Prior to excavation, the western channel would be physically isolated from the eastern channel and fish would be relocated. Relocation would involve a variety of methods, including herding them away from the site, and the use of nets and/or electrofishing to capture fish. Nets or cofferdams would be

used to prevent entry of fish into the project area during construction activities. Handling of these species would be overseen by a qualified biologist with appropriate handling permits.

The existing western channel, proposed for abandonment under Alternatives 3 and 4 and only partial filling under Alternative 2, would not be backfilled until flows were diverted to the new channel/lagoon system and fish were relocated. Backfilling the abandoned channel would be sequenced to minimize the potential for fish stranding or increases in turbidity

Under Alternative 4, excavation of the new large lagoon would be phased to protect rearing juvenile fish. First, the new channel and west portion of the lagoon would be constructed without disturbing the existing channel. Flows would then be diverted to the new channel/lagoon system, allowing lagoon excavation near the existing channel to be completed. At this time, fish from the existing channel would be relocated to the active lagoon. The second phase of lagoon excavation would be physically isolated from the active lagoon as long as possible. Sediment control measures such as silt curtains would be installed prior to connecting the excavation area to the active lagoon.

If construction were phased over several years, creek restoration would be sequenced to provide a through-going creek channel allowing fish up- and downstream passage during the period between construction seasons (November–August), which corresponds roughly with salmonid spawning and migration.

California Red-Legged Frog Habitat

Under Restoration Alternative 2, existing CRLF breeding habitat would not be disturbed. For other alternatives, new CRLF habitat would be established and functional prior to any work in existing habitat, and frog egg masses and tadpoles would be relocated. Excavation or other construction activities in existing aquatic habitat would also only occur between the dry season of August 1~~15~~–October 31, or at least before the onset of the rainy season, for protection of frogs and to ensure that actions are conducted outside of both breeding and tadpole rearing season.

Access along Pacific Way

Because some Muir Beach residences can only be accessed from Pacific Way, a road must be maintained open for vehicle access throughout construction. To allow construction of the new bridge, a temporary bypass road would be constructed to provide continuous vehicle access. The temporary road would be located south of Pacific Way and would remain active until the new bridge is completed. This bypass is expected to rejoin Pacific Way immediately east of the existing Pacific Way Bridge. To maintain vehicle access during removal of the existing bridge, the existing channel would need to be partially filled to serve as a temporary roadway. Therefore, the existing bridge would not be removed until the new bridge is finished and flows have been diverted to the new channel. If the construction footprint of the new bridge precludes this approach, another method of crossing the existing Redwood Creek channel would be used, such as laying

down a temporary clear-span bridge or installing a temporary culverted crossing and associated fill.

In addition, the pavement associated with the bypass road would not be removed until the new channel is ready to be commissioned, so that it provides a grade control to protect against channel avulsion while the project is still in construction and the existing creek channel remains in use.

Visitor Parking

Visitor parking at Muir Beach during construction would be maintained to the maximum extent possible. Portions of the parking lot may be used for staging areas, and so would result in reduced parking capacity. In addition, during construction of the new parking lot, as well as during other phases of construction to be determined, the parking lot may be closed entirely. Appropriate signage would be placed at the intersection of Hwy 1 and Pacific Way and other locations notifying visitors of the conditions at the parking lot. Construction activities would be minimized on the weekends to reduce effects on visitors, and the parking lot would be constructed in the off-peak or shoulder season when park visitation is less, if possible.

Removal of Levee Road

Currently, the levee-top road serves as the emergency access route to the beach, so the new emergency access road along the site perimeter would be constructed before removing the existing levee road. In addition, the levee road now forms a physical barrier between Redwood Creek and Green Gulch pasture. Maintaining the road in place as long as possible would isolate the creek from the construction zone, offering an interim measure to protect fish during excavation in Green Gulch pasture.

Dewatering

Dewatering of the creek channel would be conducted when construction activities are conducted in the active channel to reduce downstream sediment loads. Cofferdams and a pumped bypass would be used to dewater the construction zone, and a bypass pipe would pump flows to the downstream reaches. Because dewatering is anticipated to occur during low-flow conditions, the bypass pipe would be several inches in diameter and would be screened to avoid potential for entrainment. Salmonids in any areas to be affected would be relocated prior to dewatering, following requirements from regulatory agencies, using methods as described above. Dewatering that could affect CRLF habitat would not be conducted during breeding season. Regulatory agencies may require specific water quality for discharge of dewatering effluent. One alternative to dewatering would be the use of land-based dredging equipment (such as a hydraulic excavator or drag line) for excavation.

Excavation Production Rates

Excavation production rates were estimated to help approximate the number of years needed to create the small and large lagoons. The maximum feasible production rate for excavation and truck loading is assumed to be roughly 500 cubic yards per day. This rate is low compared to many typical construction

projects due primarily to limited areas for truck access and turn-around during excavation. Using this maximum rate, as much as 60,000 cubic yards of excavated material could be removed in a 6-month construction season. Note that the actual production rate may be less than the presumed maximum rate, given permit requirements, traffic restrictions, and other implementation conditions.

Communication Strategy

Outreach and public education about park resources is an important part of the NPS mission, and NPS intends to keep the public fully informed and up to date as planning and construction of the proposed project move forward. To that end, NPS will post regular project updates on the NPS/GGNRA web site, in hard copy at GGNRA and other area facilities, and will host public meetings at key project milestones. The project updates and meetings will be designed to help the public understand and feel connected to the project. They will explain the need for restoration and public access modifications, discuss the planned construction, provide progress reports on construction and site recovery, describe what the public can expect to see/experience at Muir Beach throughout the process, and share the vision for long-term outcomes. They will also provide contact information for NPS staff who can respond to public questions, concerns, and comments.

A key goal of the public outreach will be to reduce the effects of disruption to recreational uses at Muir Beach, by allowing visitors to choose another facility if they feel their experience at Muir Beach would be unduly compromised by construction or changing site conditions. To address potential visitor concerns, NPS will ensure that web site postings include information on parking reduction or closure, trail closures, areas affected by construction noise, and other construction- and site recovery–related issues. Notices with construction information will also be posted at Muir Beach, and at other National Parks facilities, including but not limited to the Muir Woods National Monument Visitor Center and bulletin boards, the Point Reyes National Seashore Visitor Center and bulletin boards, and the Presidio; project information will be available at <http://www.nps.gov/goga>. Construction information notices will describe the location, nature, and anticipated duration of proposed construction, and will identify the anticipated nature and duration of any closures or other changes in recreation availability at Muir Beach. Construction information notices will also identify other area facilities offering similar uses, and will include a contact name, phone number, and e-mail address for questions and concerns. Construction information notices (including information on potential closures and changes in availability) will be posted at least a month prior to construction each year, and will remain in place throughout the construction season.

Ongoing Maintenance and Management

For the purposes of the analysis, ongoing maintenance and management activities associated with this project are limited to those activities that Marin County and NPS would not undertake in absence of the project, or that are not already part of standard operating procedures (such as maintenance of roadways, restrooms, etc.).

Dredging and other maintenance of the physical characteristics of the site are not considered to be part of the project since the Restoration Alternatives are assumed to be self-sustaining without intervention through the 50-year life of the project. Unexpected future conditions could result in the need for channel dredging or other maintenance activities, which would need to be addressed through additional CEQA/NEPA documentation.

Ongoing maintenance activities under the proposed project would include the following.

- Ongoing invasive species removal.
- Maintenance of the emergency access road.
- Maintenance of plantings.
- Mosquito abatement where necessary.
- Management of fencing on the beach and at other locations in the project site to protect dune vegetation and creek habitat.

Civic Engagement in Park Stewardship

The energy and commitment of volunteers, who are often willing to engage in park care projects because they care deeply about their “back yard” park resources, represents a tremendous resource for park stewardship. Recognizing the value of this resource, NPS is developing a range of public involvement opportunities for the proposed project. Volunteer programs will be designed so that they also meet NPS’s educational responsibility, providing the public with opportunities to learn about park resources and the ecosystems they represent.

Details will be finalized as project design moves forward, but at the present time, opportunities for volunteer involvement during construction are expected to include activities such as removal of invasive non-native vegetation, native vegetation planting, and short-term planting maintenance and weeding. Following restoration construction—during site recovery and once the site has matured—volunteers will likely continue to be engaged in weeding and other aspects of planting maintenance. During site recovery in particular, volunteers may also be trained as docents to help visitors understand the long-term changes occurring on the site.

Alternatives Eliminated from Further Study

The following sections briefly describe the Restoration, Public Access and Fill Disposal alternatives that were considered but have been eliminated from detailed analysis in this Final EIS/EIR. The reasons for their elimination from further analysis are also summarized. Reasons for dismissal include technical and economic factors, inability to achieve the project purpose and need, conflicts with local or regional planning documents or requirements, and environmental factors.

Throughout the planning process, a large number of alternatives have been suggested, including numerous variants of the alternatives analyzed in this Final EIS/EIR. Thus, the following discussion is not intended to be comprehensive, but rather to provide an overview of major alternatives and the reasons why they were not considered reasonable or feasible as approaches to the proposed project. Future implementation of many of these alternatives would not be precluded by implementation of the alternatives considered in the Final EIS/EIR.

Restoration Alternatives

The following Restoration Alternatives were eliminated from Final EIS/EIR analysis.

- **Watershed Restoration to Control Sediment Input.** Restoration actions in the Redwood Creek watershed upstream of the project site have been suggested as a means of reducing sediment input to the site and addressing the source of impairment. These alternatives were eliminated from Final EIS/EIR analysis because they exceed the scope of this project. However, numerous actions have been and will continue to be undertaken through separate projects to reduce sediment loads, increase appropriate sediment trapping in the upper watershed, and refine our understanding of sediment sources.
- **Minimum Action Alternative.** A “minimum action alternative” was considered suggested which would be similar to Alternative 2 because it would entail removal of the levee road and the lower parking lot, and construction of a new Pacific Way Bridge. However, it would allow the channel to naturally relocate, or avulse, to a new location without construction of a new channel alignment. This alternative was eliminated because of the increased possibility for development of an undefined or braided stream channel with shallow water that could impair fish passage. The potential for such a condition, called the “Swampy Meadow” scenario, and its effects on fish passage, are discussed in detail in the Addendum to the Feasibility Analysis Report (Philip Williams & Associates 2004).

  There is a high degree of uncertainty as to whether or not Redwood Creek would establish a new channel in the event of a channel avulsion into Green Gulch Meadow, or whether a swampy meadow would persist. The low

gradient of the floodplain and high sediment yield makes it most likely that a channel would not become established, at least within a short to medium timescale.

If this minimum action alternative led to a swampy meadow, fish passage would be more difficult than at present. In most years there would probably be sufficient depth for adult in-migration, but there would be fewer "passable" events per season than at present. There is insufficient data and model precision to evaluate conditions for outmigration of juveniles, but it would again be harder than present.

- **Reintroduction of Extirpated Species.** Reintroduction of species—such as tidewater goby and freshwater shrimp—that are believed to have been historically present in the Big Lagoon system was not considered because it would not fulfill the purpose of the project. However, implementation of the Restoration Alternatives analyzed in this Final EIS/EIR is not expected to preclude future reintroduction of appropriate native species.

Public Access Alternatives

The following Public Access Alternatives were eliminated from Final EIS/EIR analysis.

- **Dual Parking Lots.** Provision of two parking lots, such as one at the Alder Grove and one in the general vicinity of the existing parking lot, was not considered due to the potential for increased traffic congestion as drivers circulate between lots looking for parking places.
- **Shrinking Parking Lots.** Parking lots that would be designed to shrink as public transit use rises were not considered because demand for personal vehicle parking is expected to remain at current levels or increase, regardless of increased public transit opportunities. <u>However, if public transit opportunities become available and parking demand declines after project implementation, NPS could take separate actions at that time to reduce the size of the parking lot.</u>
- **Remote Parking Lot.** Construction of a remote parking lot, such as one at the Old Ballfield, at the intersection of Hwy 1 and Muir Woods Road, would create public safety hazards as pedestrians attempt to cross Hwy 1, and would impair public access to the popular site to a significant degree, which is inconsistent with NPS goals for the site.
- **Alternative Transportation.** Limited public transit access is already provided to the site. Planning and provision of more accessible and visitor-friendly public transportation into the future is beyond the scope of this project. New modes of public transportation to this and nearby recreational sites were considered through the CTMP project in 2003 and 2004, but the CTMP project is no longer engaged in active planning. However, Marin County is currently working with Caltrans to plan a transit stop at the intersection of Hwy 1 and Pacific Way.

- **Separate Access Road.** Provision of a separate access road adjacent to Pacific Way for Muir Beach visitors was not considered further due to the potential for additional environmental impacts associated with construction and use of such a road. Construction of an additional road would likely result in a net loss of wetland acreage under the terms of the Corps.
- **Street-Side Parking.** Providing street-side parking along Pacific Way or Hwy 1 is not being considered because it would increase the footprint of the roadways, with potential for additional environmental impacts associated with construction and use of such parking. It would also raise safety and traffic congestion issues along these roadways as vehicles are parking and visitors wait for parking spaces to open.
- **Parking Lot on Green Gulch Property.** A parking lot on Green Gulch property is not proposed because the San Francisco Zen Center Board of Directors, as property owner, opposed use of their land for this purpose.

Bridge Alternatives

The following Bridge Alternatives were eliminated from Final EIS/EIR analysis.

- **Alternative Bridge Configurations.** While a variety of bridge configurations were evaluated in Appendix D, only a subset were subjected to analysis in the Final EIS/EIR since they captured the reasonable range of possible bridge configurations and potential impacts.
- **Alternative Access.** At present, Pacific Way is a dead-end street. Possibilities for connecting Pacific Way with other surface streets was considered, as it would eliminate the need for all-weather access at the bridge. However, no feasible locations for such a roadway connection were identified.

Fill Disposal Alternatives

Several alternatives for fill disposal were proposed and rejected, as follows.

- **Barging and Deep Offshore Disposal.** This alternative was not considered further because it was the most costly and logistically difficult alternative, involving saturating excavated material to make a slurry, pumping to a barge, and transporting the material several miles offshore for deep ocean disposal.
- **Pumping and Shallow Offshore Disposal.** This alternative was not considered further as it would not be allowed within the Gulf of the Farallones National Marine Sanctuary.
- **Landfill Disposal.** Landfill disposal was not considered further due to the presence of other cheaper options for fill disposal which would still result in beneficial reuse of the fill material.

- **Reuse at Santos Meadows.** This site is owned by California State Parks, which does not support use of the site for fill disposal.
- **Disposal at Lower Banducci Field.** This site was not considered further due to technical infeasibility of placing fill within an active floodplain.
- **Stockpiling or Reuse at Former Ball Field.** This site was not considered further due to technical infeasibility of placing fill in a historic floodplain that is proposed by NPS to be restored as an active floodplain.
- **Stockpiling and/or Disposal at Green Gulch Farm.** This site was not considered further because possible fill placement locations are jurisdictional wetlands regulated by USACE.

Preferred Alternative

The preferred alternative~~s~~ consists of Restoration Alternative 2 (Creek Restoration), Public Access Alternative B4~~B3~~ (a 175-car parking lot at the beach rotated parallel to Pacific Way), Bridge Alternative BR4~~BR3~~ (a 250~~150~~ foot–long bridge with a raised road at each end), disposal of fill materials at the Unused Reservoir Pit, and composting of appropriate materials on NPS property at the Upper Banducci Field. Some suitable fill material may also be used for the Dias Ridge recontouring, or possible Coastal Trail recontouring, if it is available, but all material would be used or safely deposited within the watershed. This alternative is shown in Figure 2-24. It should be noted that between circulation of the Draft EIS/EIR and publication of the Final EIS/EIR, the preferred Public Access and Bridge Alternatives have been changed from B3 to B4, and BR3 to BR4, respectively. Public Access Alternative B4 and Bridge Alternative BR4 are now preferred for their superior benefits related to long-term hydraulic and sediment transport processes, which have been determined to be more beneficial to the long-term protection of habitats at the site. These are minor technical changes that, pursuant to State CEQA Guidelines section 15088.5, “Recirculation of an EIR Prior to Certification,” do not require recirculation of the Draft EIS/EIR. This combination of project features (Restoration Alternative 2, Public Access Alternative B4, and Bridge Alternative BR4) is most consistent with the NPS mission, offers the best combination of project benefits, including factors related to both the project’s purpose and need and its impacts, as follows:

- It will restore a functional, self-sustaining ecosystem to the maximum extent of any of the alternatives.
- It will support sustainable populations of existing special status species.
- It will ensure improved vehicle access for the Muir Beach community.
- It will provide a visitor experience that is compatible with ecosystem restoration and historic preservation.
- It will have a relatively small construction footprint, relatively short construction duration, and will minimize construction-related impacts such as dust, noise, and the need to haul and dispose of fill.

- ~~It will be less costly than other alternatives considered which could have marginally greater environmental benefits.~~

The project would be completed consistent with NPS and Marin County regulations and requirements.

Identifying~~Selection of~~ the Preferred Alternative

As required by NPS policy, a Value Analysis process was used to inform the selection of the preferred alternatives. The Value Analysis process identifies project-specific evaluation factors based on project goals and the NPS mission. It then identifies and ranks the relative advantages of each of the alternatives in meeting the evaluation factors. When completed, the results show which alternative provides the greatest benefit to meet project goals and the NPS mission. Evaluators do not consider costs to compare advantages, but they are used to develop a cost-benefit ratio. The cost-benefit ratio shows whether substantially added costs provide substantially added benefits. A more expensive alternative may be shown to be more advantageous if its substantially added costs produce substantially added benefits. Costs are also used to refine alternatives to either increase benefits or reduce costs that do not produce benefits.

Separate Value Analysis evaluations were used to evaluate the Restoration Alternatives, the Public Access Alternatives, and the Bridge Alternatives. A neutral, experienced facilitator guided each of the three Value Analysis processes. Each set of alternatives was evaluated for specific objectives within the categories of natural resource protection, cultural resource protection, public and worker health and safety, visitor enjoyment, operational efficiency, and minimization of construction impacts.

Based on the benefits comparison for all categories combined, Restoration Alternative 2 had the highest ranking of overall advantages. Project goals can be met through Alternative 2, with substantial improvements in natural channel function, habitat quality, and flood reduction. The Value Analysis method of comparing costs of alternatives showed that although Alternatives 3 and 4 had added habitat and flood reduction benefits, their substantially higher costs—due primarily to the much greater quantities of fill that would have to be excavated and hauled down Hwy 1—would not bring substantially greater value to the project. Alternative 2 therefore had the highest cost benefit ratio. The primary restoration costs, not including all construction tasks, would be approximately $4 million for Restoration Alternative 2 versus $10 million for Restoration Alternative 3 and $16 million for Restoration Alternative 4.

Based on the benefits comparison, the two Public Access Alternatives that retained the same capacity as the existing parking lot (B3 and B4) were ranked as having the most benefits because they would not affect parking capacity and therefore had the least traffic impacts, while minimizing creek functioning. NPS initially selected Public Access Alternative B3, a 175-car lot that shortens the

existing parking lot more than the minimum removal of the lower 90 feet and builds into a portion of the adjacent riparian area, as the preferred alternative in the Draft EIS/EIR. Although Alternative B3 is smaller than Alternative B4 (resulting in less impact on wetlands and mature riparian areas), it is particularly important to NPS that the new parking lot avoid impacts on the creek and upstream flooding. The preferred Public Access Alternative therefore has been changed from B3 to B4 in this Final EIS/EIR for its superior geophysical and long-term ecological benefits related to improved flood protection through the lowest portion of the reach and improved sediment transport to the beach and nearshore environment. As previously stated, this is a minor technical change that, pursuant to State CEQA Guidelines section 15088.5, does not require recirculation of the Draft EIS/EIR prior to its certification. ~~The two public access alternatives that retained the same capacity as the existing parking lot were ranked as having the most benefits since traffic impacts would not be worsened by either shrinking or expanding the capacity, although Alternative B4 was ranked with slightly higher advantages than B3. It was particularly important to NPS that the new parking lot avoids impacts to the creek and upstream flooding, which can be fully achieved through Alternative B3 without rotating the parking lot as in Alternative B4, although Alternative B4 had slightly higher advantages with expanding flow connectivity. Compared to Alternative B4, Alternative B3 had the added advantage of retaining more of the mature riparian area and avoiding loss of wetlands in the parking lot footprint because its total size is about the same as the existing lot and smaller than that of Alternative B4. Alternative B3 also had a higher cost-benefit ratio, because much less fill would need to be moved for B3 than for B4 to achieve similar benefits.~~

The initial Value Analysis ~~benefits comparison~~ showed that Bridge Alternative BR4, the longest possible bridge, had slightly higher benefits than Bridge Alternatives BR3 and BR2, which were equally ranked, and Bridge Alternative BR1 had almost no benefits since it would obstruct flood flows. Marin County initially selected Bridge Alternative BR3 as the preferred alternative, but the preferred Bridge Alternative has been changed from BR3 to BR4 in this Final EIS/EIR. This change is based on an understanding that the longer bridge will provide substantially greater benefits than BR3 for both floodplain function and vehicular access. The longer bridge would accommodate greater flows and minimize potential obstructive effects on backwater flows that could increase flood elevations upstream. Bridge Alternative B4 has also been shortened from 266–300 feet to 250 feet because the shorter length is a more realistic design length, when existing constraints on Pacific Way are taken into account more fully. Its maximum width has been narrowed from 36 feet to a maximum possible width of 32 feet. Again, changing the preferred Bridge Alternative from BR3 to BR4 is a minor technical change that, pursuant to State CEQA Guidelines section 15088.5, does not require recirculation of the Draft EIS/EIR prior to its certification.

Costs for the bridge alternatives presented in the Draft EIS/EIR were slightly underestimated for some alternatives and overestimated for others. Some assumptions related to bridge costs have been refined for the FEIS. The original costs, and the revised costs based on conceptual designs are: Bridge Alternative

BR4, $4.3 million in the DEIS/EIR, now estimated at 4.4 million; BR3, $3 million in the DEIS/EIR, now estimated at $3.5 million; BR2, $2 million in the DEIS/EIR, now estimated at $1.5 million; and BR1, estimated at $2.1 million in the DEIS/EIR and now estimated at $2.1 million. The County has selected the longer Bridge Alternative (BR4) despite its higher cost than BR3 because of its substantially greater benefits for both creek and floodplain function and access for residents during flood events. The BR4 alternative also is expected to require the least maintenance. ~~Evaluators found that Bridge Alternative BR4's benefits were only slightly greater than other alternatives, but its costs were substantially greater, meaning that added costs did not bring substantially added benefits. Bridge Alternative BR4 had an estimated cost of $4.3 million compared to $3 million for Bridge Alternative BR3 and $2 million for Bridge Alternative BR2. Bridge Alternative BR2 and Bridge Alternative BR3 each accommodate natural processes and flood flows through different means, with the short bridge of BR2 allowing flood flows to pass over the road and the longer bridge of BR3 allowing high flows on the floodplain to pass under bridge. Based on this important difference, Bridge Alternative BR3 was selected as the preferred alternative, despite its higher cost than Bridge Alternative BR2, because BR3 provides both greater natural resource benefits and better vehicular passage than BR2,~~

Benefits of the Preferred Alternative

The combined benefits of the preferred alternatives selected for this project, the Restoration, Public Access, and Bridge Alternatives, will bring to life a long-term vision for restoring ecological integrity to the mouth of one of the San Francisco Bay Area's most treasured and natural watersheds. Redwood Creek flows from Mount Tamalpais to the coast in a largely protected watershed, but it is at its most confined, dysfunctional, and fragmented condition at the project site. When this project is implemented, the dynamic interaction of natural processes will once again return to virtually the full landscape for the first time in almost 100 years. Modern anthropogenic influences on this scenic Marin County coastal lowland will not be fully erased, but the project will still enable the forces of a natural stream to retake their place as the centerpiece of the landscape.

The combined set of preferred alternatives will allow a natural and dynamic evolution of the creek, floodplain and wetland system; remove as many obstacles as reasonably possible to natural processes; minimize the need for maintenance; and reconcile conflicts with desirable human activities to the extent possible. Water, waves, and wind will create landforms, aquatic niches, and naturally sustained habitat without undue human interference or landscape relicts.

While benefits and impacts of the Restoration, Public Access, and Bridge Alternatives are analyzed separately in this Final EIS/EIR, the greatest benefits will occur due to the combination of these three project components. Each component addresses a particular obstruction to natural creek processes that have contributed to a downward trajectory in salmonid habitat quality and increased flooding. The combined benefit of creek realignment under Restoration Alternative 2, parking lot reconfiguration under Public Access Alternative ~~B3~~B4

(previously Public Access Alternative B3), and Pacific Way Bridge Alternative ~~BR3~~ BR4 (previously Bridge Alternative BR4) will create the most unobstructed creek and floodplain in the project area since about the 1920s. All of the components function together to improve flow conveyance, sediment transport, floodplain function and habitat value, while also improving vehicular access and maintaining visitor and residential access. Sediment will be transported more effectively because the creek channel will be relocated to its natural topographic low point and will slope at a more natural gradient, and there will no longer be obstructions from an undersized floodplain next to the parking lot or an undersized Pacific Way Bridge. The preferred parking lot alternative will expand adjacent floodplain from its current 50 feet of width to a minimum of ~~180~~approximately 350 feet of width, and there would be unobstructed floodplain on the opposite side of the creek.

The project will provide the benefits that are most needed by resident coho salmon and steelhead. Essential habitat qualities needed by salmonids during winter flow conditions will be enhanced. When the creek is reconnected with contiguous floodplain habitat throughout the entire 38-acre project site, salmon using the essential floodplain habitat will no longer be obstructed from returning to the creek by a levee or a road. The floodplain will meet one of the most important winter-time needs of juvenile coho—a good feeding ground for fattening up before migrating to the ocean, thereby enhancing their chances of survival and return. New backwater habitat both upstream and downstream of Pacific Way, together with the expanded floodplain connection, will also provide steelhead and coho with areas where they can take refuge during the force of high velocity flows, a habitat quality that is currently deficient in Redwood Creek. With these improvements, the survival of young steelhead and coho over winter months is expected to improve.

The new, longer Pacific Way Bridge proposed as part of this project offers an ecological benefit that has rarely been used in typical road engineering. It will not only improve vehicular access during the winter, but it will be long enough to also span an additional ~~115~~ 215 feet of floodplain width, thereby retaining the important upstream-downstream floodplain connection for both fish habitat and natural creek meander. Whereas residents currently experience restricted road access under routine winter events, the new bridge and raised road will allow vehicular access in all but very large storm events, and even then, access will only be limited for a short duration. Although this project cannot prevent flooding in a natural floodplain, road access will be available even if there are long-term changes in flood elevations since both the road and the bridge will be higher and designed to allow for long-term channel changes. With good road access to residences during winter events, the current demand for creek dredging to reduce flooding will subside.

Visitors will experience the benefits of this project through the opportunity to witness the restoration process, which takes on new meaning as the public awareness of human interference on ecological functions grows. People seek out national parks across the United States to restore their personal sense of aliveness in places where nature unquestionably thrives. This wetland and creek restoration

at Big Lagoon would allow the estimated ~~440,000~~260,000 annual visitors to the site to share the experience of witnessing an ecosystem regaining its natural function. Even in the project's infancy after construction, when trees are immature and native wetland species have not yet colonized their likely niches, NPS expects that visitors will appreciate and enjoy the new integrity of the site as a whole, with the reconfigured parking lot acting as a less imposing central feature of the coastal landscape. Stewardship volunteers will reap a personalized enjoyment from their hands-on participation in revegetating native plant communities after construction. Visitor facilities will also be enhanced, with the parking lot blending more pleasantly with its surroundings through vegetated wetland swales, installation of new vault toilets, and, in particular, through a new trail from Hwy 1 to the parking lot. The trail will meet ADA standards, and it will provide pedestrians with an access route to the beach where conflicts with vehicles can be avoided. The trail will join a new trail alignment up Dias Ridge, making a trail available from Panoramic Highway to the beach for the first time.

The benefits of removing the channel confinements are expected to extend all the way downstream to the intermittent tidal lagoon at the north end of the beach, which will be able to scour more effectively with the improved force of winter flows from upstream. This will allow the intermittent tidal lagoon to incorporate more natural variability in its areal extent and depth. With added log structures, reminiscent of the natural large debris that would have washed downstream to the beach in the period before watershed development, the coho and steelhead will have improved cover in the intermittent lagoon.

One of the least-seen beneficiaries of this project may be the CRLF, a federally threatened species whose numbers at the site are so low that their very persistence there is in jeopardy. Because its current habitat is provided by the same features that obstruct creek processes and promote ponding, this project takes the long view toward providing a more hydrologically sustainable habitat for the frog. This project will remove the channel confinements, but will retain the cattail habitat at the south end of the Green Gulch pasture. It will also excavate new ponds that will be fed by groundwater and will support emergent vegetation where frogs lay their eggs. Should augmentation of the existing red-legged frog population be required, the improved habitat conditions should support any added frogs. With these changes and with an additional new breeding population on NPS lands at the Banducci site (0.5 mile upstream) as part of separate actions, CRLF population within the Redwood Creek watershed will be sustainable for the long-term.

The benefits of this project extend well below ground to the buried archaeological resources at the site. It is the mission of NPS to protect cultural resources, and this project will succeed in not only protecting them, but in learning more about them than had this project never been conducted. Coast Miwok who once lived in this region have left good evidence of their hunting and fishing activities at Muir Beach. As part of the project planning, NPS has conducted explorations of the subsurface shellmounds to learn more about the dates and types of Coast Miwok use. New information about the Coast Miwok activities here will be used in a new cultural resource interpretation of the site

that will add depth to the public understanding of earlier human use as well as earlier landscapes.

Beyond enhanced protection and interpretation of archeological sites, the project will also help re-establish the connection of a living indigenous tribe, the Federated Indians of Graton Rancheria, with parts of our parklands. An ecological restoration that includes a cultural-ecological component derived from the traditions and land uses of indigenous people will create a visible and tangible fabric with deep interpretive potential to visitors and respect to the original occupants of these lands.

One of the benefits of the project approach is that the ecological, flood reduction, and visitor enhancements can be achieved without having to haul truckloads of excavated fill long distances down Hwy 1 or through the commercial area of Mill Valley. The project alternatives can be constructed with all fill either reused in the local watershed or placed safely and sustainably in the Unused Reservoir Pit on NPS property.

Environmentally Preferable Alternative

NEPA requires identification of the environmentally preferable alternative. Director's Order 12 references Section 101(b) of NEPA as the criteria to be used to determine the environmentally preferred alternative. Section 101(b) states that environmentally preferred alternative is one that:

- fulfills the responsibilities of each generation as trustee of the environment for succeeding generations;
- assures for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
- attains the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
- preserves important historic, cultural and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;
- achieves a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
- enhances the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Director's Order 12 interprets this to mean the alternative that causes the least damage to biological and physical environment; or best protects (i.e., preserves or enhances) cultural and natural resources.

CEQA similarly requires identification of the environmentally superior alternative. For the purposes of this document, the term "environmentally preferable alternative" is used in place of "environmentally superior alternative."

The environmentally superior alternative is Restoration Alternative 2, Public Access Alternative ~~B3~~B4, Bridge Alternative BR4, and the Unused Reservoir Pit. Each is discussed in more detail below in Table 2-8, which provides a comparison of the beneficial and adverse effects of the alternatives that were analyzed.

Restoration Alternatives

Restoration Alternative 2 is considered the environmentally preferable Restoration Alternative. This is due to the fact that it achieves similar long-term benefits with respect to ecological value and visitor/resident experience; however, construction would have a smaller footprint, would be of shorter duration than either Restoration Alternatives 3 or 4, and would require less haulage of fill off-site. This would result in reduced impacts related to:

- the physical environment in terms of air quality (fewer construction-related dust and exhaust emissions);
- biological resources in terms of disturbance to on-site vegetation and wildlife communities;
- cultural resources in terms of potential disturbance of previously undiscovered cultural resources; and
- social resources in terms of reduced effects on recreation and visitor/resident experience during construction, including effects related to construction-related vehicle trips, aesthetics, and noise.

While this alternative would not reduce flooding to the same extent as the other alternatives, the benefits identified above related to construction are determined to outweigh this shortcoming. Neither Alternative 3 nor 4 were identified as the environmentally preferable alternative because their added ecological benefits would not exceed the consequent construction impacts, particularly related to the number of truck trips on Hwy 1 and through Mill Valley to remove excavated materials. Even after substantial excavation, each of these alternatives would be subject to considerable in-filling within 50 years.

Public Access Alternatives

Public Access Alternative B4 is considered the environmentally preferable Public Access Alternative, because of its superior geophysical and long-term ecological benefits related to improved hydraulic capacity under large storm events, improved sediment transport to the beach and nearshore environment, and improved flood protection. It also does not have the same potential for reduced

Table 2-8. Alternatives Comparison Summary

Alternative	Important Features	Beneficial Effects	Adverse Effects	Conclusions Regarding Resource Impairment
Restoration Alternatives				
Alternative 1—No Action	• Ongoing maintenance dredging only as permitted for flood reduction	Minimizes construction-related effects of the action alternatives by restricting effects to periodic maintenance dredging.	Allows for continued flooding of Pacific Way, including issues related to emergency access and potential for channel avulsion and related damage to infrastructure and potential effects to fish passage and stranding. Periodic short-term impacts related to maintenance dredging, including water quality, noise, and aesthetics. Potential impacts to California red-legged frog due to need for annual management intervention to maintain breeding habitat.	Impairment is not likely, however a significant impact could occur due to channel avulsion. Avulsion would create the potential for loss of existing park resources or take of listed fish species due to inadequate conditions related to fish passage.
Alternative 2—Creek Restoration	• Realign Redwood Creek and create backwater channels and marsh • Remove Levee, Shorten Parking Lot by 90 feet • Dune and tidal lagoon restoration • Interim flood reduction measures	Reduces potential for channel avulsion and potential impacts to fish passage, and improves natural functioning of site. Provides winter and summer refugia for salmonids. Reduces flood levels. Improves dune habitat and tidal lagoon function. Reduces some invasive plant populations, and increases the extent of riparian habitat, with corollary benefits to bird species. Improves aesthetics and visitor experience through restoration of site.	Construction-related impacts from interim flood reduction actions and during the 3-year restoration project, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Potential impacts to California red-legged frog from construction. Reduced extent of emergent wetland habitat.	Impairment is not likely to occur. Potential for impairment due to effects on California red-legged frog would be avoided through avoiding existing aquatic habitat, proper construction practices and creation of new on-site and off-site habitat.
Alternative 3—Creek and Small Lagoon Restoration	• Realign Redwood Creek and create two open-water lagoons • Remove Levee, Shorten Parking Lot by 90 feet • Dune and tidal lagoon restoration • Interim flood reduction measures	Reduces potential for channel avulsion and potential impacts to fish passage and stranding, and improves natural functioning of site. Provides winter and summer refugia for salmonids. Reduces flood levels. Improves dune habitat and tidal lagoon function. Reduces some invasive plant populations, and increases the extent of open water and riparian habitats, with corollary benefits to bird species. Improves aesthetics and visitor	Construction-related impacts from interim flood reduction actions and during the 4-year restoration project, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Large construction footprint. Requires approximately 5,000-10,000 fill haul trips, many of which would proceed over a long haul distance to Hamilton AFB Wetlands. Reduced	Impairment is not likely to occur. Potential for impairment due to effects on California red-legged frog would be avoided through proper construction practices and creation of new on-site and off-site habitat.

Table 2-8. Continued

Alternative	Important Features	Beneficial Effects	Adverse Effects	Conclusions Regarding Resource Impairment
		experience through restoration of site. Restores some of the benefits of the pre-Euroamerican lagoon to the site, and allows for sediment storage in lagoons over time.	extent of emergent wetland habitat. Potential impacts to California red-legged frog from construction and relocation, as well as due to salinity effects and predation in brackish lagoons.	
Alternative 4—Large Lagoon Restoration	• Realign Redwood Creek and create one large open-water lagoon • Remove Levee, Shorten Parking Lot by 90 feet • Dune and tidal lagoon restoration • Interim flood reduction measures	Reduces potential for channel avulsion and potential impacts to fish passage and stranding to the greatest extent, and improves natural functioning of site. Provides winter and summer refugia for salmonids. Reduces flood levels to the greatest extent. Improves dune habitat and tidal lagoon function. Reduces some invasive plant populations, and greatly increases the extent of open water habitat. Improves aesthetics and visitor experience through restoration of site. Restores benefits of the pre-Euroamerican lagoon to the site, and allows for sediment storage in lagoon over time.	Construction-related impacts over 4 years including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Largest construction footprint. Requires approximately 8,750-17,500 fill haul trips, many of which would proceed over a long haul distance to Hamilton AFB Wetlands. Reduced extent of emergent wetland habitat. Potential impacts to California red-legged frog from construction and relocation, as well as due to salinity effects and predation in brackish lagoon.	Impairment is not likely to occur. Potential for impairment due to effects on California red-legged frog would be avoided through proper construction practices and creation of new on-site and off-site habitat.
Public Access Alternatives				
Alternative A	• No Action—175 car parking lot is not modified	Eliminates construction-related effects of the action alternatives.	Continues to restrict flood flows and natural channel function by not removing lower 90 feet of lot. Does not provide the benefits associated with the action alternatives of the new pedestrian trail from Hwy 1 to the beach.	Impairment is not likely to occur.

Table 2-8. Continued

Alternative	Important Features	Beneficial Effects	Adverse Effects	Conclusions Regarding Resource Impairment
Alternative B1	• 50 cars at beach • Pedestrian path on Pacific Way Bridge and at edge of road	Smallest footprint of any alternative, with benefits to aesthetics, habitat and floodplain function. Water quality and habitat benefits from vegetated swales between parking rows. Improves aesthetics and rustic character of site. Provides improved safety by constructing grade-separated pedestrian path.	Substantial parking shortfalls, including inadequate parking during all weekends and on weekdays during the peak season. Cascading effects on residents, visitors and visitor experience. Construction-related impacts, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife.	Impairment is not likely to occur.
Alternative B2	• 145 cars at beach in footprint of existing parking lot • Pedestrian path on Pacific Way Bridge and at edge of road	Similar footprint to existing conditions. Water quality and habitat benefits from vegetated swales between parking rows. Provides improved safety by constructing grade-separated pedestrian path.	Substantial parking shortfalls, including inadequate parking during on weekends during the peak and shoulder seasons, and on weekdays during the peak season. Cascading effects on residents, visitors and visitor experience. Construction-related impacts, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife.	Impairment is not likely to occur.
Alternative B3	• 175 cars at beach and removal of the lower end of parking lot, plus expansion into adjacent riparian area • Pedestrian path on Pacific Way Bridge and at edge of road	Provides similar parking capacity as existing conditions, with shortfalls only experienced on weekends during the peak season. Water quality and habitat benefits from vegetated swales between parking rows. Provides improved safety by constructing grade-separated pedestrian path.	Small disturbance to existing riparian forest. Construction-related impacts, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife.	Impairment is not likely to occur.

Table 2-8. Continued

Alternative	Important Features	Beneficial Effects	Adverse Effects	Conclusions Regarding Resource Impairment
Alternative B4	• 175 cars at beach • Parking lot rotated parallel to Pacific Way • Pedestrian path on Pacific Way Bridge and at edge of road	Provides similar parking capacity as existing conditions, with shortfalls only experienced on weekends during the peak season. Provides benefits to the floodplain by being rotated parallel to flow. Water quality and habitat benefits from vegetated swales between parking rows. Provides improved safety by constructing grade-separated pedestrian path.	Results in disturbance of existing riparian forest. Construction-related impacts, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Aesthetic impacts to residents near the lot.	Impairment is not likely to occur.
Alternative B5	• 200 cars at beach • Pedestrian path on Pacific Way Bridge and at edge of road	Provides greatest parking capacity, with very small (1-car) shortfalls on weekends during the peak weekend. Water quality and habitat benefits from vegetated swales between parking rows. Provides improved safety by constructing grade-separated pedestrian path.	Results in disturbance of existing riparian forest. Construction-related impacts, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Aesthetic impacts due to larger footprint.	Impairment is not likely to occur.
Alternative C	• 118 cars at Alder Grove adjacent to Hwy 1 • Pedestrian trail from Alder Grove to beach • Transit turnaround at beach • Pedestrian path on Pacific Way Bridge and at edge of road	Small footprint at the beach, with benefits to aesthetics, habitat and floodplain function. Water quality and habitat benefits from vegetated swales between parking rows. Provides improved safety by constructing grade-separated pedestrian path.	Substantial parking shortfalls, including inadequate parking during all weekends and on weekdays during the peak season. Results in disturbance of existing riparian forest at Alder Grove. Aesthetic, traffic and safety impacts due to location on Hwy 1, and trail to beach. Construction-related impacts, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife.	Impairment is not likely to occur.
Bridge Alternatives				
Alternative BR0	• No Action—existing Pacific Way Bridge is not replaced	Eliminates construction-related effects of the action alternatives.	Allows for continued flooding of Pacific Way, including issues related to emergency access. Restricts vehicle access to one-way traffic across bridge.	Impairment is not likely to occur.

Table 2-8. Continued

Alternative	Important Features	Beneficial Effects	Adverse Effects	Conclusions Regarding Resource Impairment
Alternative BR1	• 50-foot bridge span • Raised roadway	Substantially alleviates flooding of Pacific Way. Allows for 2-way traffic and a pedestrian walkway.	Raises flood elevations upstream. Would reduce floodplain width, limit sediment conveyance, and the ability for the channel to migrate over time. Construction-related effects, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Aesthetic effects from new bridge.	Impairment is not likely to occur. Increased potential for the narrow bridge span to impact the value of Redwood Creek by reducing floodplain connectivity and natural channel function.
Alternative BR2	• 50-foot bridge span • Low roadway	Alleviates flooding of Pacific Way somewhat. Reduces flood elevations upstream. Allows for 2-way traffic and a pedestrian walkway.	Reduces floodplain connectivity, ability for the channel to migrate over time, and increases the potential for channel avulsion. Construction-related effects, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Aesthetic effects from new bridge.	Impairment is not likely to occur. Increased potential for the narrow bridge span to impact the value of Redwood Creek by reducing floodplain connectivity and natural channel function.
Alternative BR3	• 150-foot bridge span • Raised roadway	Substantially alleviates flooding of Pacific Way. Allows for 2-way traffic and a pedestrian walkway. Improves channel stability, floodplain connectivity, natural channel function, and fish passage conditions.	Construction-related effects, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Aesthetic effects from longer and higher bridge.	Impairment is not likely to occur.
Alternative BR4	• ~~266–300~~ 250 foot bridge span (reduced from 266-300 feet) • Spans entire floodplain	Alleviates flooding of Pacific Way to the greatest extent. Reduces flood elevations upstream. Allows for 2-way traffic and a pedestrian walkway. Offers greatest benefits with respect to channel stability, floodplain connectivity, natural channel function, and fish passage conditions.	Construction-related effects, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Aesthetic effects from longest and highest bridge.	Impairment is not likely to occur.

Table 2-8. Continued

Alternative	Important Features	Beneficial Effects	Adverse Effects	Conclusions Regarding Resource Impairment
Fill Disposal Alternatives				
Unused Reservoir Pit	• Materials used to fill in existing man-made pit. • 0.75 mile haul distance	Would contribute to restoring existing manmade feature to natural conditions. Relatively short haul distance.	Fill disposal activities would be visible from the Coastal Trail. Effects of fill disposal include air quality, water quality, noise, aesthetics, visitor experience, and traffic.	Impairment is not likely to occur.
Upper Banducci Fields	• Materials spread in agricultural field • 0.5 mile haul distance	Shortest haul distance.	Would require construction of temporary creek crossing for site access. Effects of fill disposal include air quality, water quality, noise, aesthetics, traffic, natural communities, and wildlife.	Impairment is not likely to occur.
Hamilton Air Force Base Wetlands Restoration	• Materials used to help complete large tidal wetland restoration • 20 mile haul distance	Would contribute to large wetland restoration.	Long haul distance would increase traffic and emissions. Effects of fill disposal include air quality, water quality, noise, aesthetics, and traffic.	Impairment is not likely to occur.
Dias Ridge Trail Recontouring	• Materials used to repair trail • 2.5 mile haul distance	Would repair existing degraded trail. Relatively short haul distance.	Would temporarily impede hiking on the Dias Ridge Trail. Effects of fill disposal include air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities, and wildlife.	Impairment is not likely to occur.
Coastal Trail Recontouring	• Materials used to repair trail • 0.75 mile haul distance	Would repair existing degraded trail. Relatively short haul distance, and would not involve hauling on public roadways.	Would temporarily impede hiking on the Coastal Trail. Effects of fill disposal include air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities, and wildlife.	Impairment is not likely to occur.

visitor experience, and community and traffic effects related to reduced parking lot capacity. In addition, it avoids the adverse effects to aesthetics and biological resources of the larger lot and the remote lot. The additional disturbance to the natural environment from rotation of the lot is offset by the long-term benefits in terms of site geomorphology and floodplain function; Public Access Alternative B3 still would obstruct the processes of rare, very large magnitude events.~~Public Access Alternative B3 is considered the environmentally preferable Public Access Alternative. It does not have the potential for reduced visitor experience, or traffic effects related to reduced parking lot capacity. In addition, it avoids the adverse effects to aesthetics and biological resources of the larger lot and the remote lot. This alternative will create a minimum distance of about 180 feet from the creek expanding to 240 feet where the available width is currently 50 feet, and there will also be an unobstructed floodplain on the opposite side of the creek for the first time. With this available area, this alternative fully achieves the primary purpose of parking lot modifications, which is to avoid impacts to high flows and upstream flooding. In addition, this alternative it will not increase the footprint of the parking lot on wetlands since it is about the same size as the existing lot, helping the project avoid a net loss of jurisdictional wetland area due to fill placement.~~

Alternatives that reduced or expanded the capacity of the parking lot were not identified as environmentally preferable because of the reduced visitor experience and traffic impacts that would result from either scenario. ~~Alternative B4 (the same existing capacity but a different configuration) was not selected as the environmentally preferable alternative because its larger size would cause a greater loss of mature riparian habitat and a potential net loss in jurisdictional wetland habitat, without substantial added benefits for channel function or flood reduction.~~

Bridge Alternatives

Technical studies conducted as part of this Final EIS/EIR examined flood behavior and sedimentation for a range of bridge length and bridge location alternatives. In general, these studies found that wider bridge spans resulted in less backwater effect upstream and less scour at the bridge opening. Bridge Alternative BR4 has been determined to be the environmentally preferable Bridge Alternative. Construction-related effects are anticipated to be similar among all the Bridge Alternatives. However, the longer span of Bridge Alternative BR4 would reduce upstream flooding to the greatest extent and would allow the greatest level of all-weather access; this bridge would provide access during a very large magnitude event (i.e., much larger than a 10-year event and probably as close as possible to a 100-year event). Its ultimate capacity would be determined during project design, when other design constraints can be fully considered simultaneously by bridge engineers ~~by locating the bridge entirely above the 100-year flood elevation~~. In conjunction with Alternative B4, this alternative would provide the greatest level of natural stream function by allowing adequate room for natural hydrological processes such as channel migration to reestablish, which would in turn improve salmonid habitat. ~~and~~

~~floodplain connectivity.~~ Its long span would also reduce upstream flooding to the greatest extent.

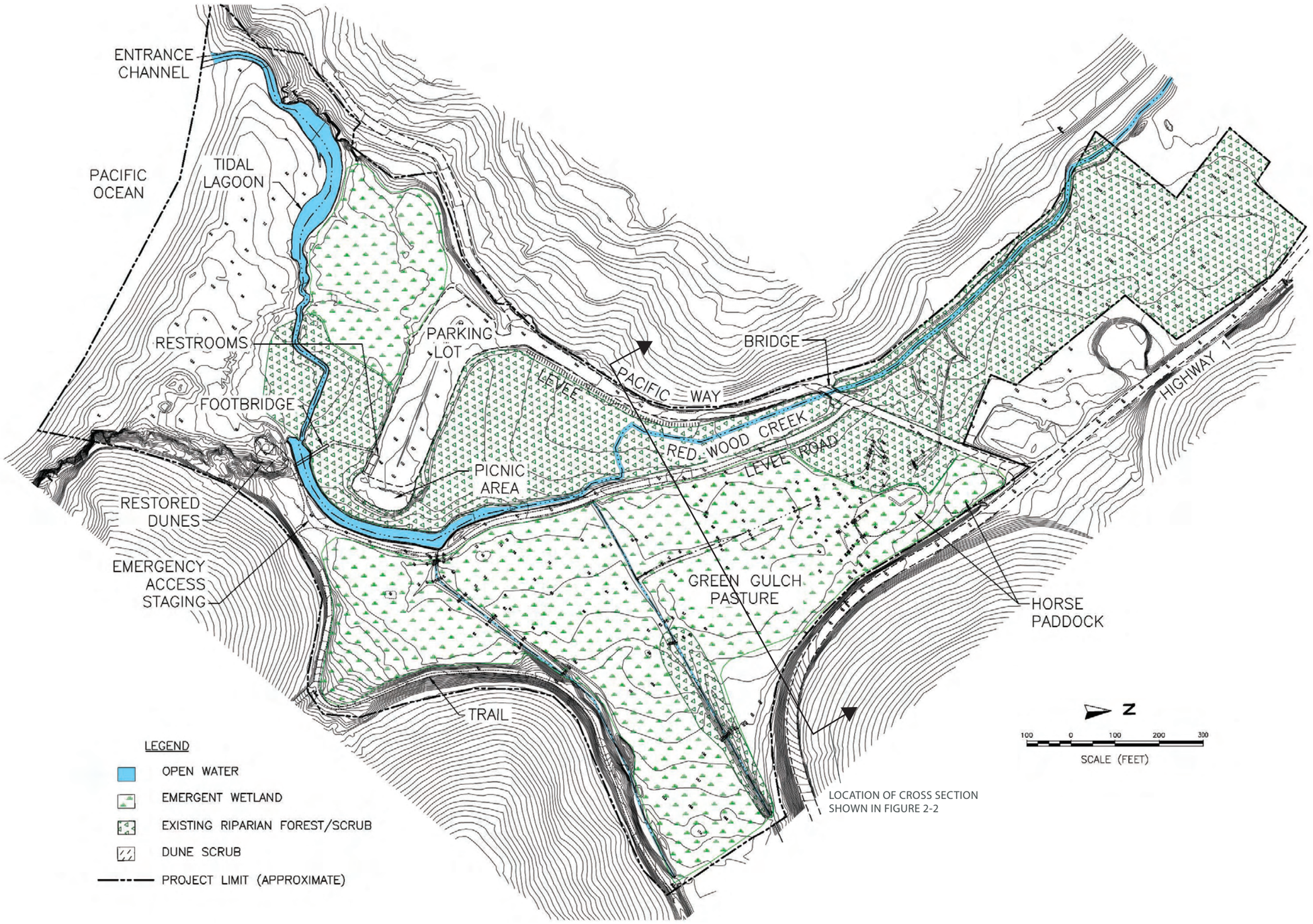
Alternative BR3 was not identified as the environmentally preferable alternative because under some large flood events, the bridge would still be overtopped by floodwaters, though it would remain passable for vehicles. Shorter bridges were not identified as environmentally preferable because they would be joined by either a low or a raised road connection; a low road would ~~result in frequent flooding events similar to existing conditions~~ be subject to inundation during flood events, while a raised road would result in higher flood elevations that would potentially cause more damage compared to existing conditions.

Fill Disposal Alternatives

The Unused Reservoir Pit is considered the environmentally preferable Fill Disposal Alternative. This is because it would have a relatively short haul distance, would not involve extensive site upgrades to allow for fill disposal, and would restore an existing man-made feature to a more natural configuration. While other alternatives may have shorter haul distances (e.g., Upper Banducci Field), or provide for similar if not greater ecological benefits (Hamilton Wetlands Restoration), they do not offer the same combination of minimizing adverse impacts while maximizing beneficial impacts.

Comparison of Alternatives

Table 2-8 provides a summary comparison of the alternatives analyzed, including beneficial and adverse effects. All alternatives are generally consistent with local plans. All action alternatives would meet the project purpose and need and would be consistent with the intent of CEQA, NEPA and other applicable environmental laws and policies. The No Action Alternative would not satisfy project purpose and need. Potential environmental consequences and consistency with local plans are analyzed in more detail in Chapter 4, *Environmental Consequences*.



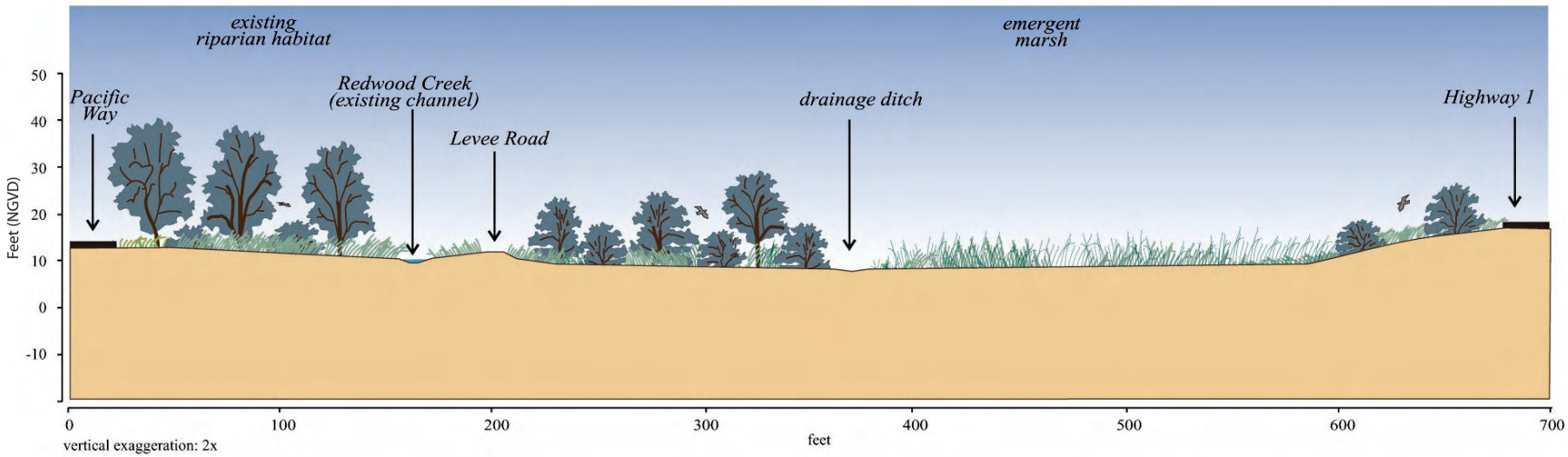
Source: PWA 2004

05052.05 EIR/EIS (2/05)

Jones & Stokes

Figure 2-1
Alternative 1 - No Project Alternative
Year 0

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2004

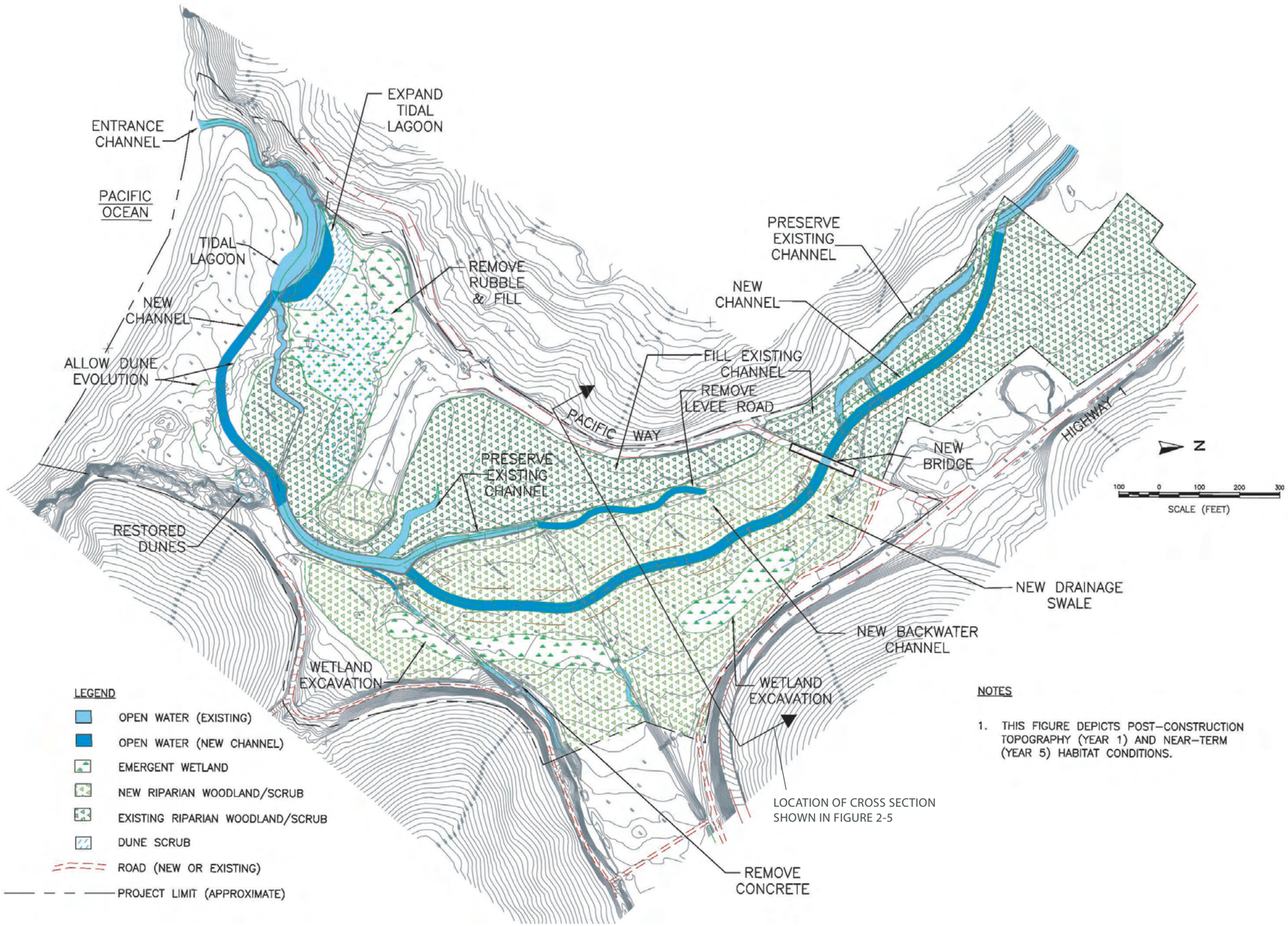
Note: Location of cross section is shown in Figure 2-1

05052.05 EIR/EIS (2/05)

Jones & Stokes

Figure 2-2
Alternative 1 -No Project Alternative
Conceptual Profile View

Exhibit 2: Final Environmental Impact Statement



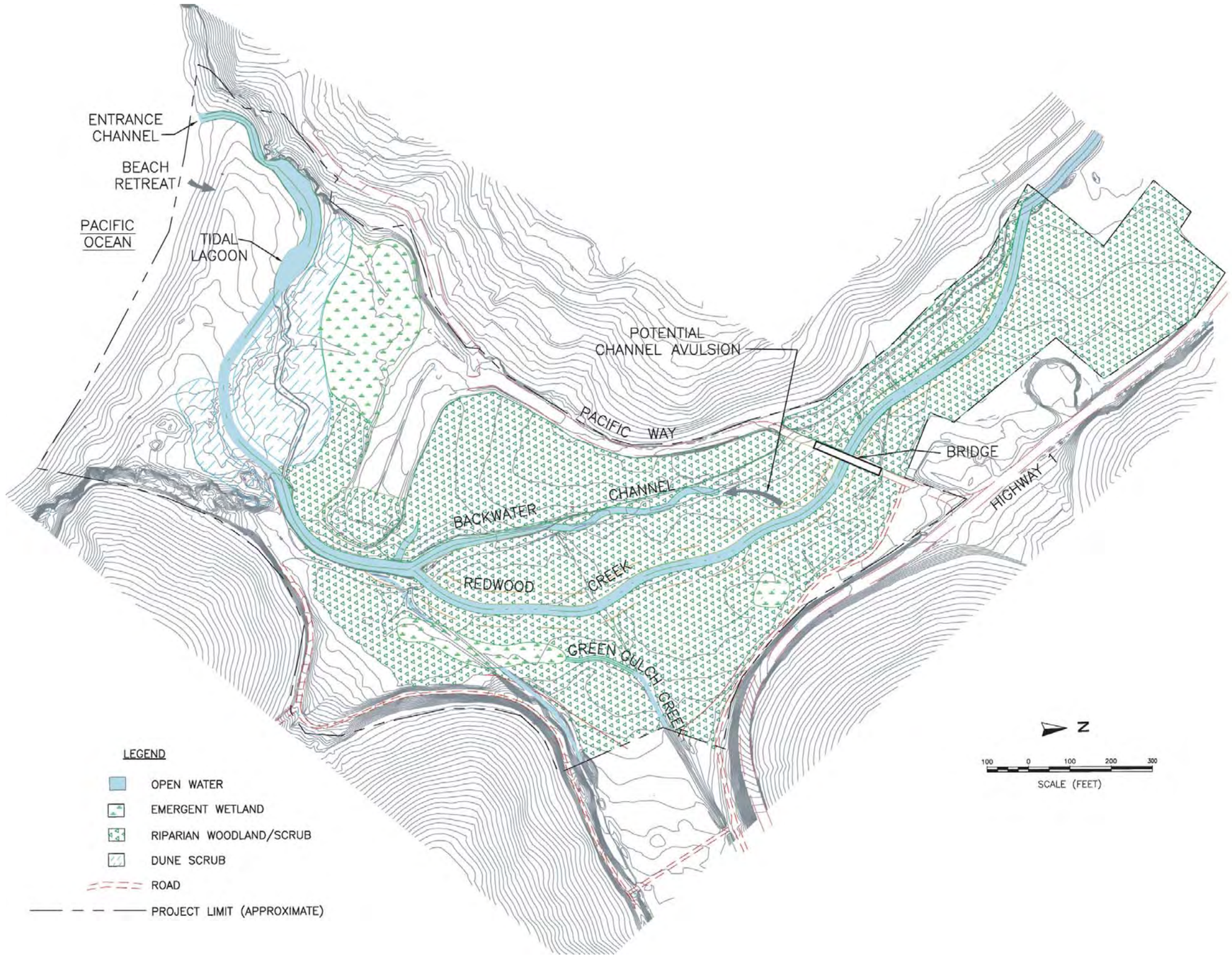
Source: PWA 2006

05052.05 EIR/EIS (rev. 9/06)

Jones & Stokes

Figure 2-3
Alternative 2 – Creek Restoration
Year 0

Exhibit 2: Final Environmental Impact Statement



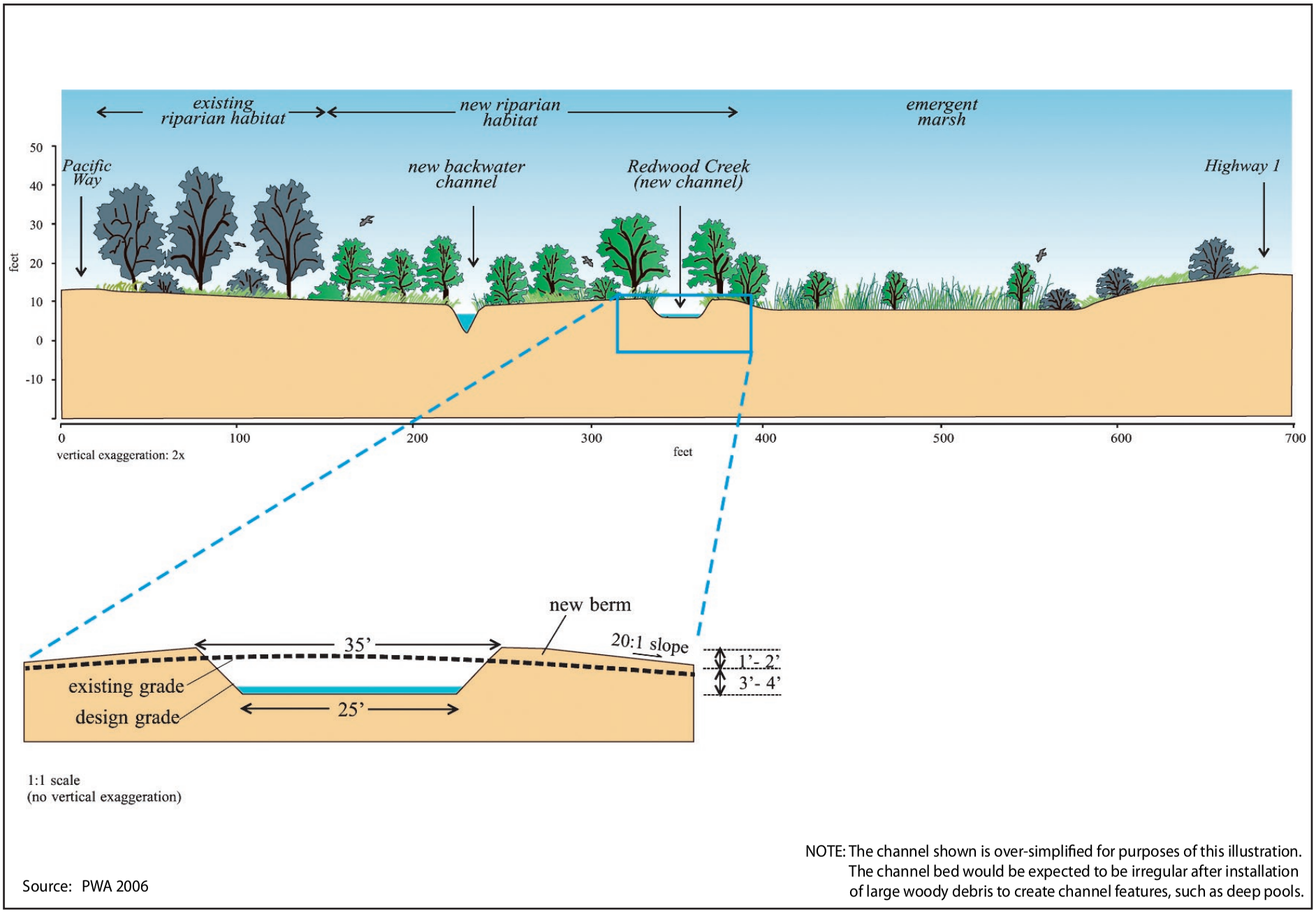
Source: PWA 2006

05052.05 EIR/EIS (rev 9/06)

Jones & Stokes

Figure 2-4
Alternative 2 – Creek Restoration
Year 50

Exhibit 2: Final Environmental Impact Statement



NOTE: The channel shown is over-simplified for purposes of this illustration. The channel bed would be expected to be irregular after installation of large woody debris to create channel features, such as deep pools.

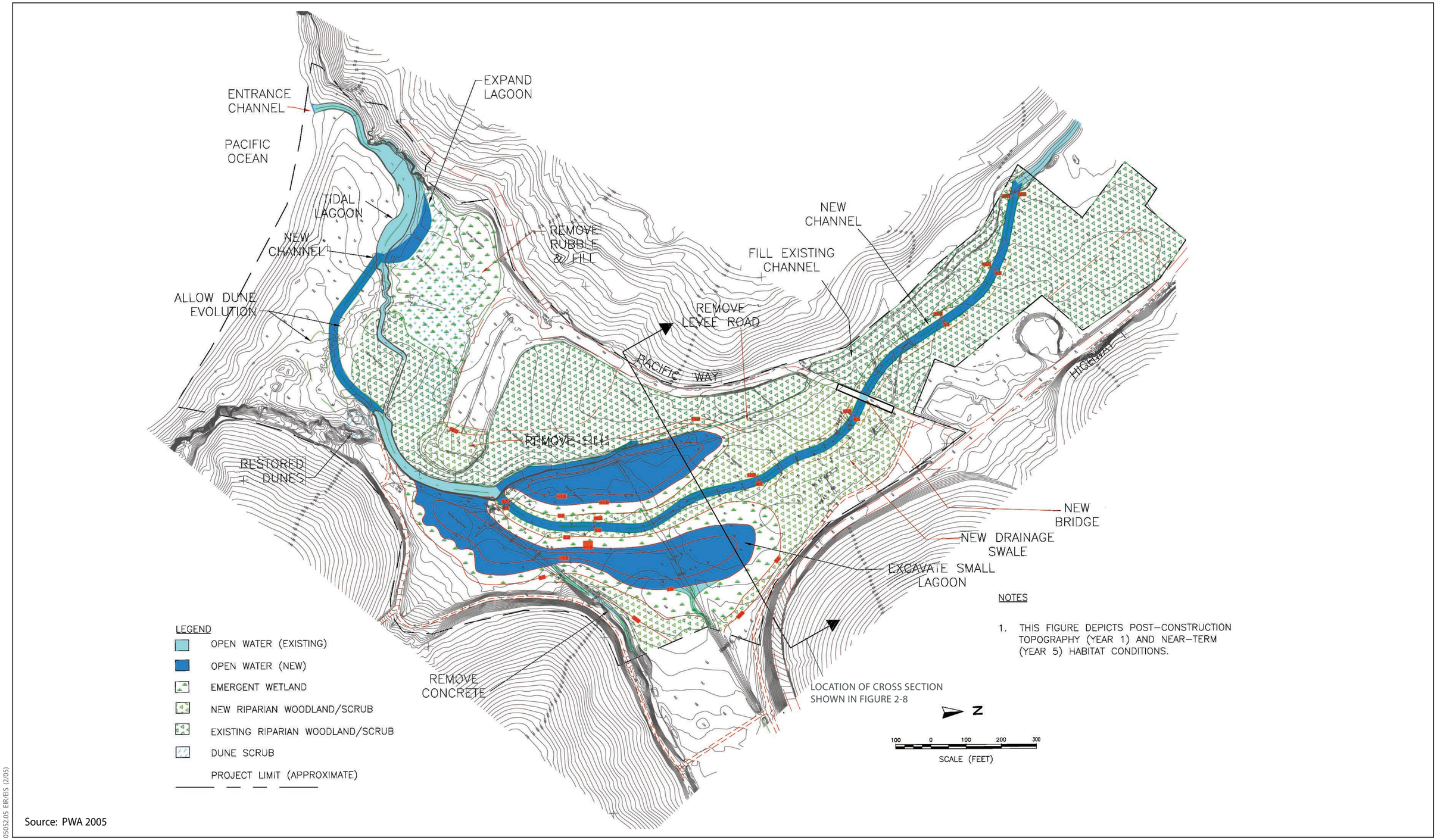
Source: PWA 2006

05052.05 EIR/EIS (rev. 10/06)

Jones & Stokes

Figure 2-5
Alternative 2 – Creek Restoration
Conceptual Profile View

Exhibit 2: Final Environmental Impact Statement



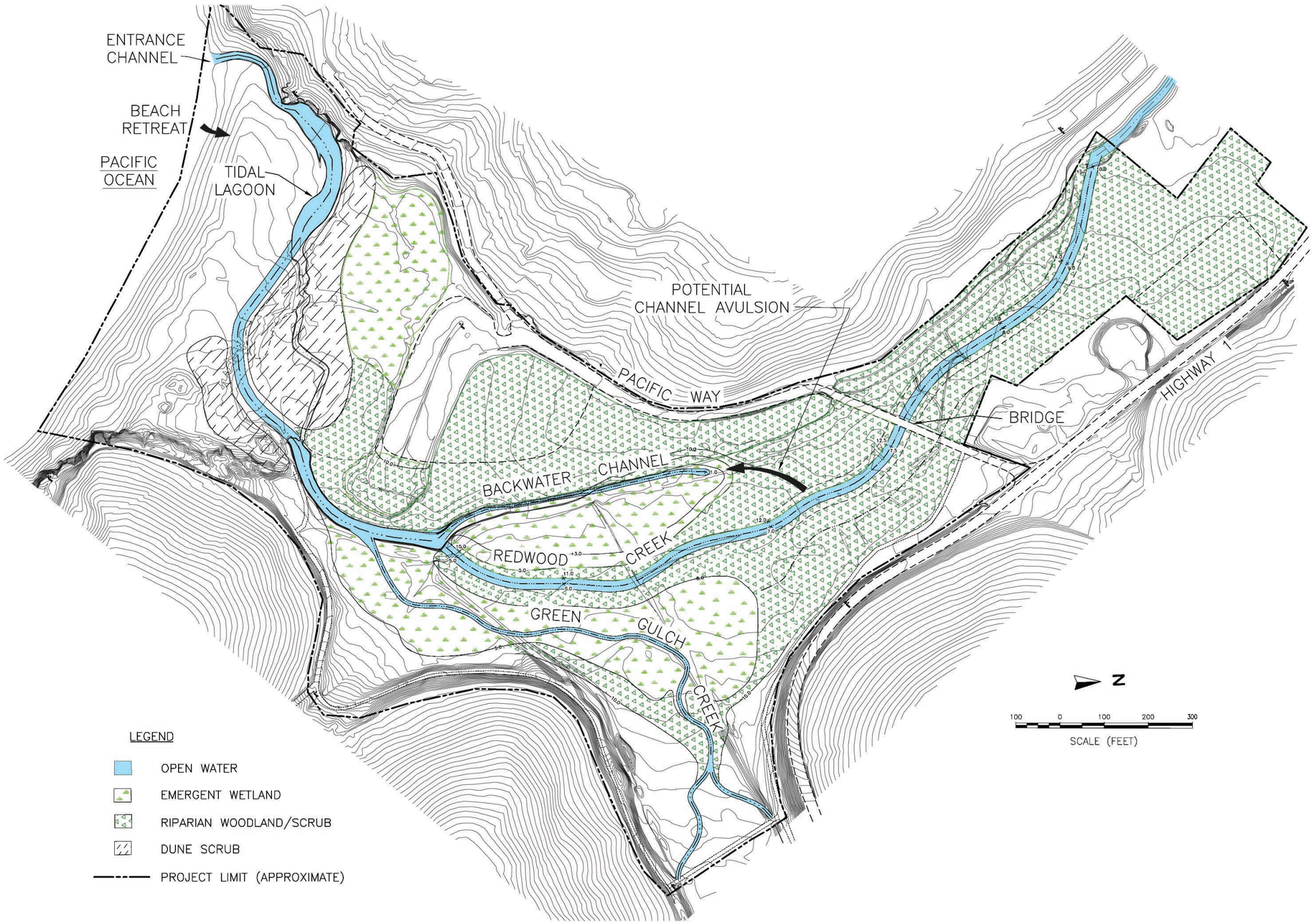
Source: PWA 2005

05052.05 EIR/EIS (2/05)

Jones & Stokes

Figure 2-6
Alternative 3 – Creek and Small Lagoon Restoration
Year 0

Exhibit 2: Final Environmental Impact Statement



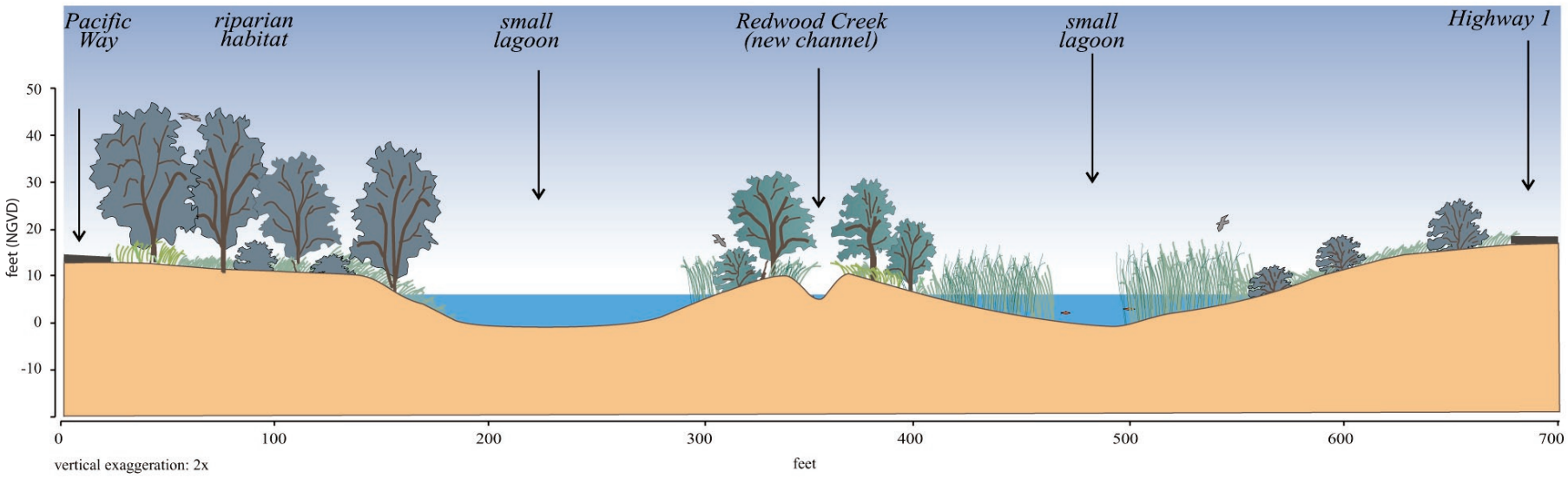
Source: PWA 2004

05052.05 EIR/EIS (2/05)

Jones & Stokes

Figure 2-7
Alternative 3 – Creek and Small Lagoon Restoration
Year 50

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2004

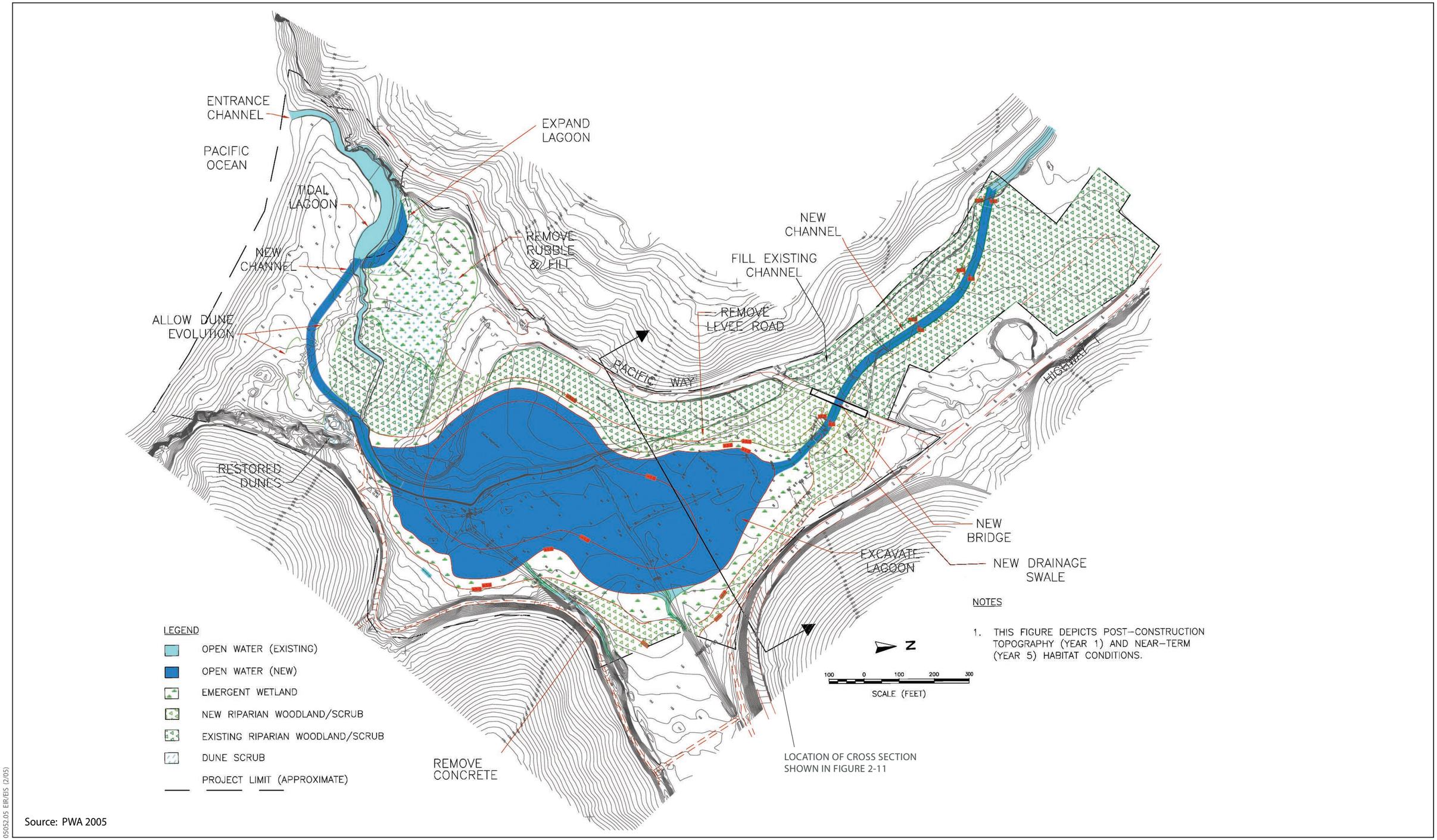
Note: Location of cross section is shown in Figure 2-6

05052.05 EIR/EIS (rev 9/06)

Jones & Stokes

Figure 2-8
Alternative 3 – Creek and Small Lagoon Restoration
Conceptual Profile View

Exhibit 2: Final Environmental Impact Statement



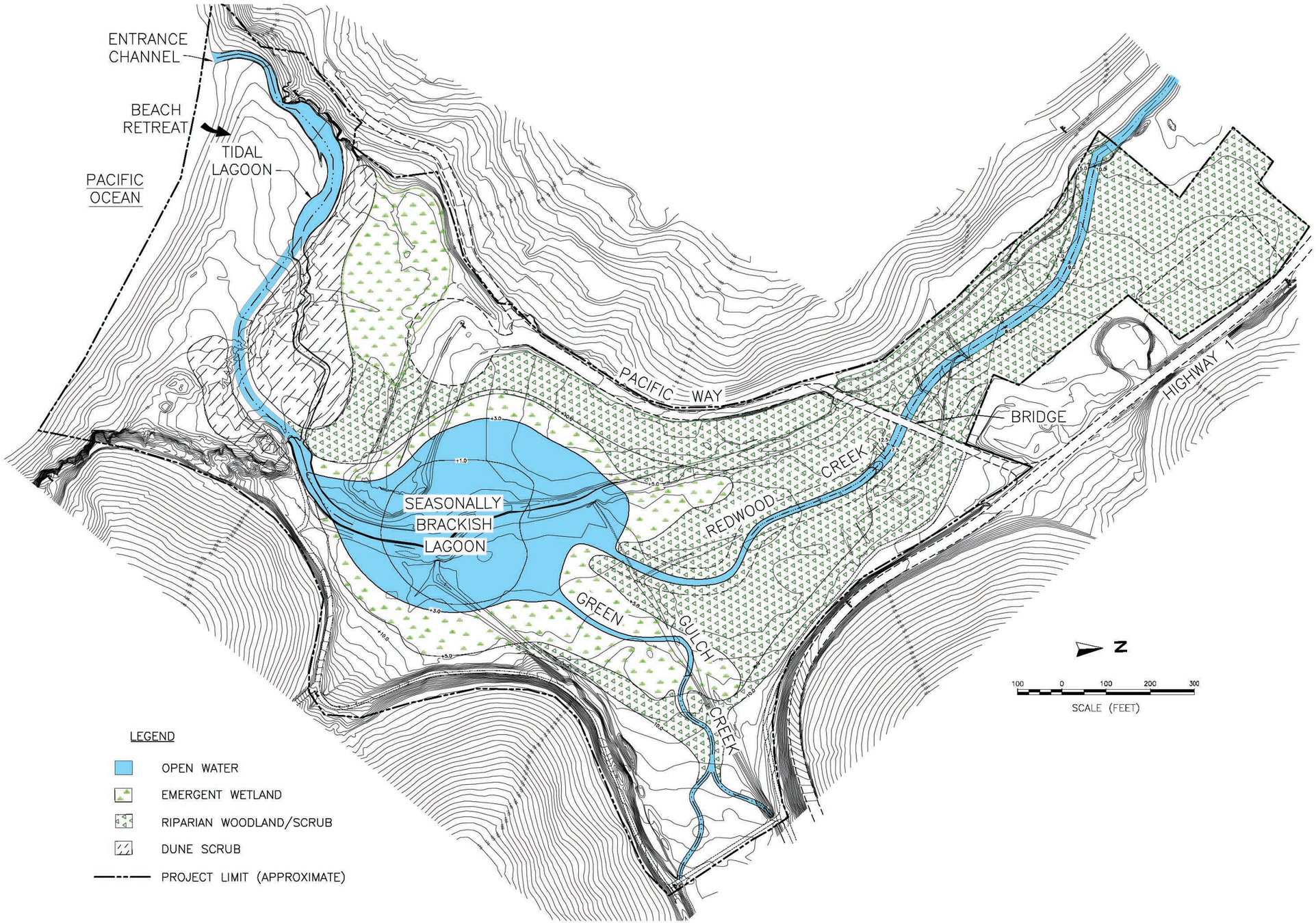
Source: PWA 2005

05052.05 EIR/EIS (2/05)

Jones & Stokes

Figure 2-9
Alternative 4 – Large Lagoon Restoration
Year 0

Exhibit 2: Final Environmental Impact Statement



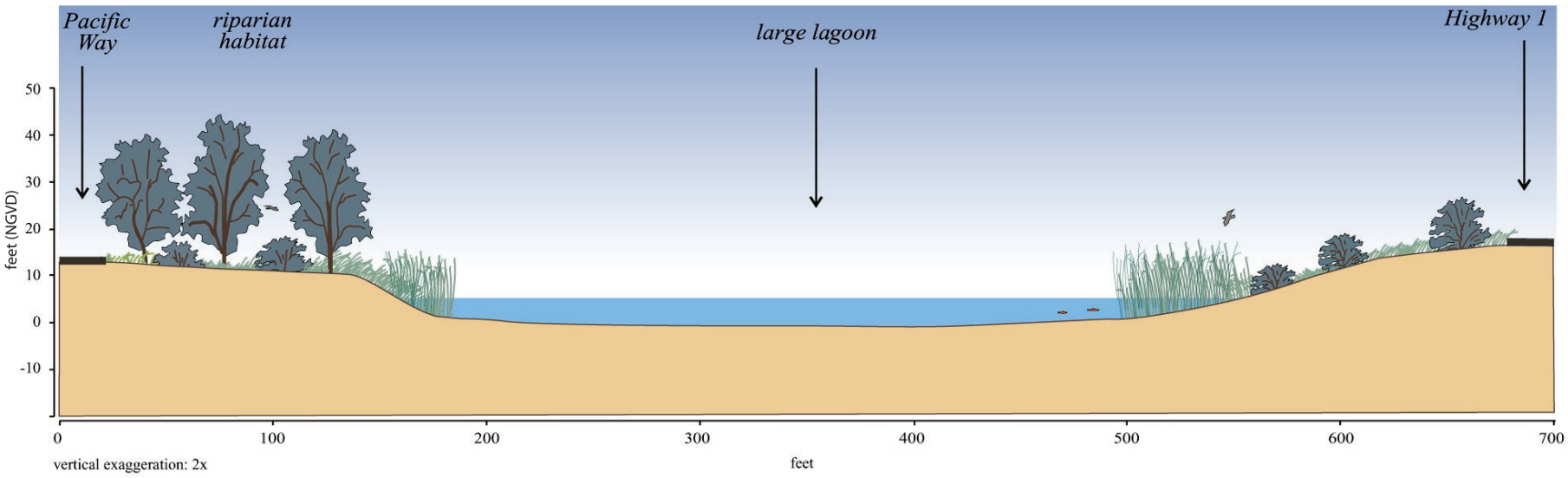
Source: PWA 2004

05052.05 EIR/EIS (2/05)

Jones & Stokes

Figure 2-10
Alternative 4 – Large Lagoon Restoration
Year 50

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2004

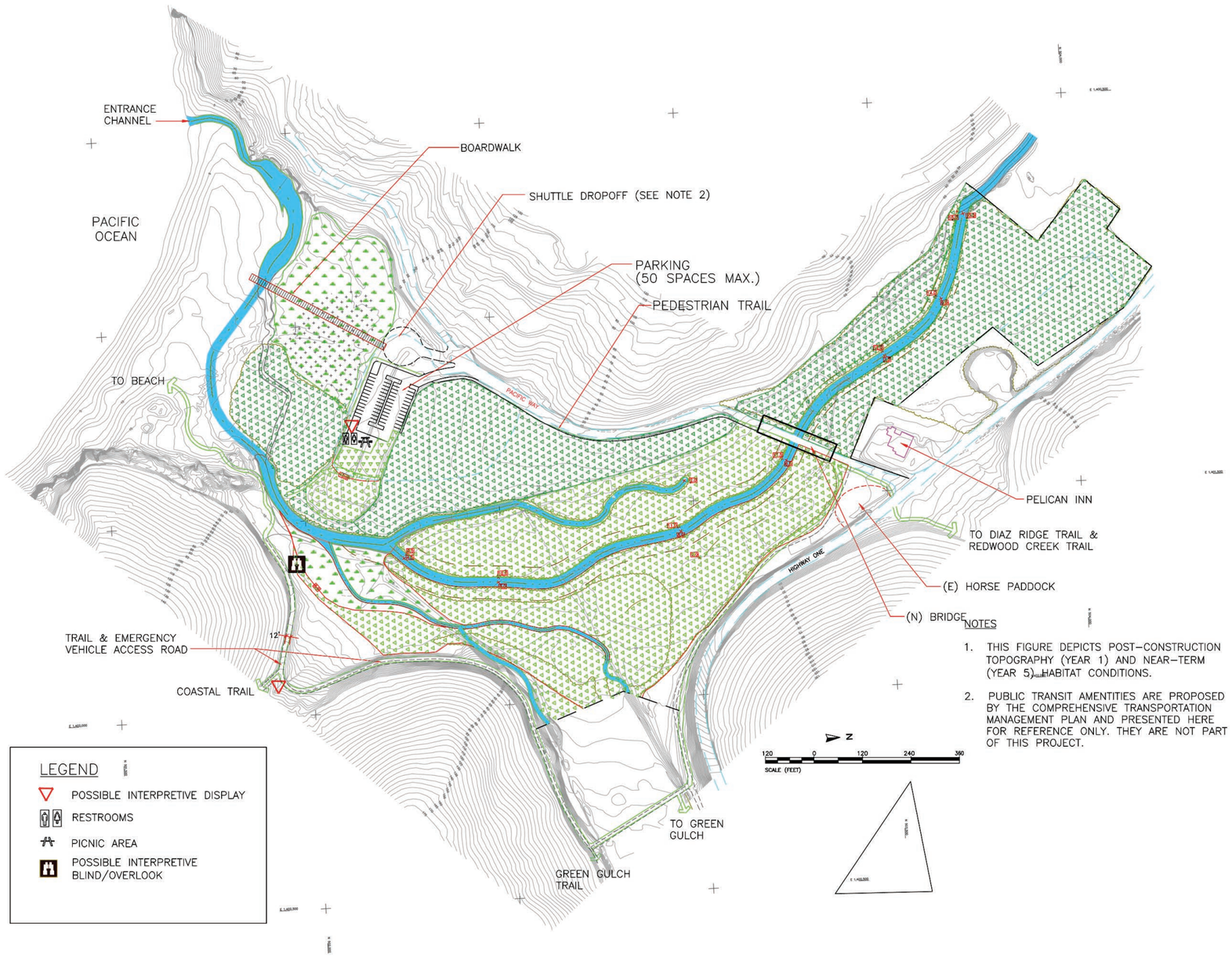
Note: Location of cross section is shown in Figure 2-9

05052.05 EIR/EIS (rev 9/06)

Jones & Stokes

Figure 2-11
Alternative 4 – Large Lagoon Restoration
Conceptual Profile View

Exhibit 2: Final Environmental Impact Statement



NOTES

1. THIS FIGURE DEPICTS POST–CONSTRUCTION TOPOGRAPHY (YEAR 1) AND NEAR–TERM (YEAR 5) HABITAT CONDITIONS.
2. PUBLIC TRANSIT AMENTITIES ARE PROPOSED BY THE COMPREHENSIVE TRANSPORTATION MANAGEMENT PLAN AND PRESENTED HERE FOR REFERENCE ONLY. THEY ARE NOT PART OF THIS PROJECT.

Source: PWA 2004, NPS 2005

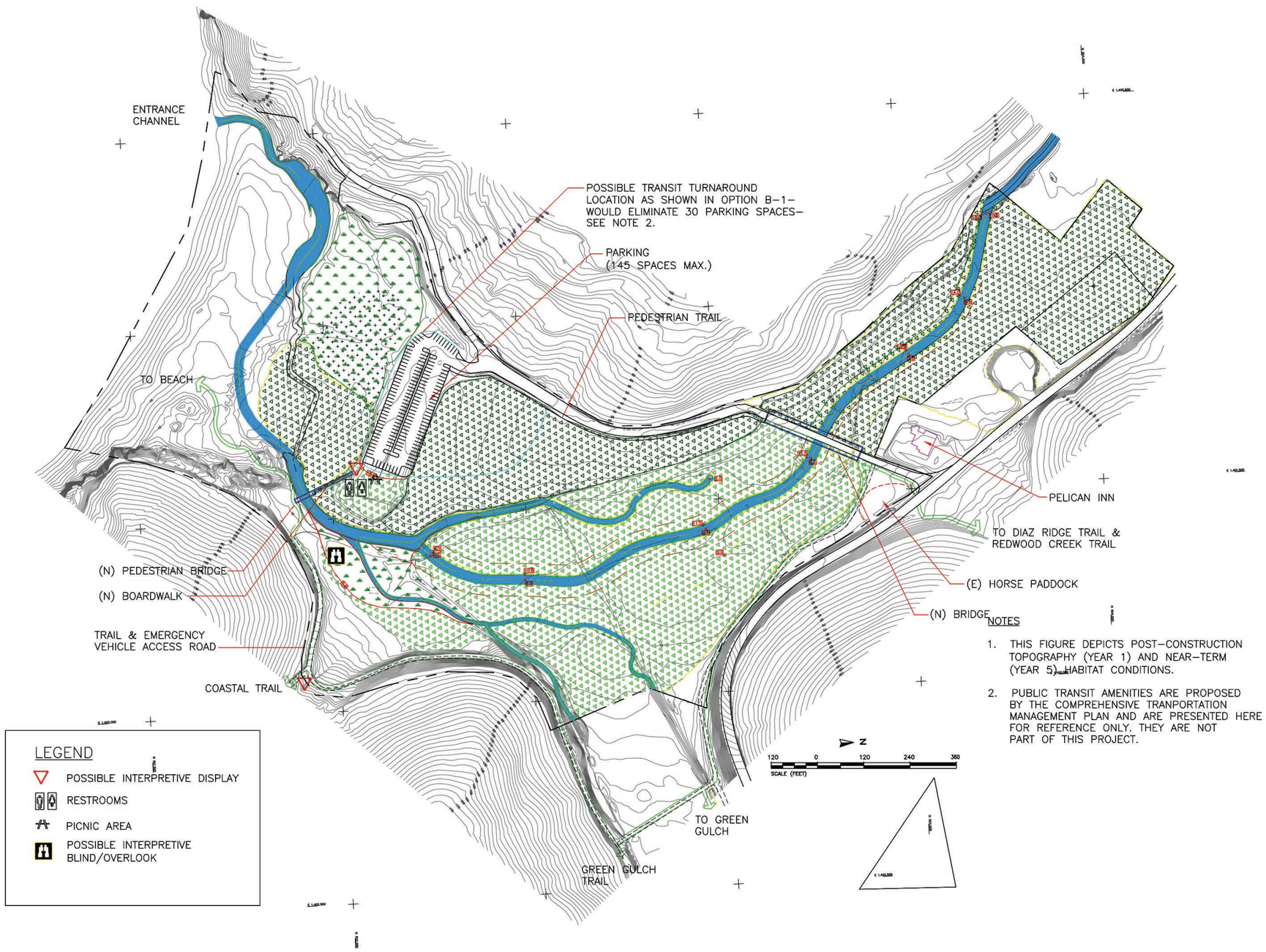
Note: Shown with previous version of Restoration Alternative 2

05052.05 EIR/EIS (rev. 7-06)

Jones & Stokes

Figure 2-12
Public Access Alternative B1

Exhibit 2: Final Environmental Impact Statement



NOTES

1. THIS FIGURE DEPICTS POST-CONSTRUCTION TOPOGRAPHY (YEAR 1) AND NEAR-TERM (YEAR 5) HABITAT CONDITIONS.
2. PUBLIC TRANSIT AMENITIES ARE PROPOSED BY THE COMPREHENSIVE TRANPORTATION MANAGEMENT PLAN AND ARE PRESENTED HERE FOR REFERENCE ONLY. THEY ARE NOT PART OF THIS PROJECT.

Source: PWA 2004, NPS 2005

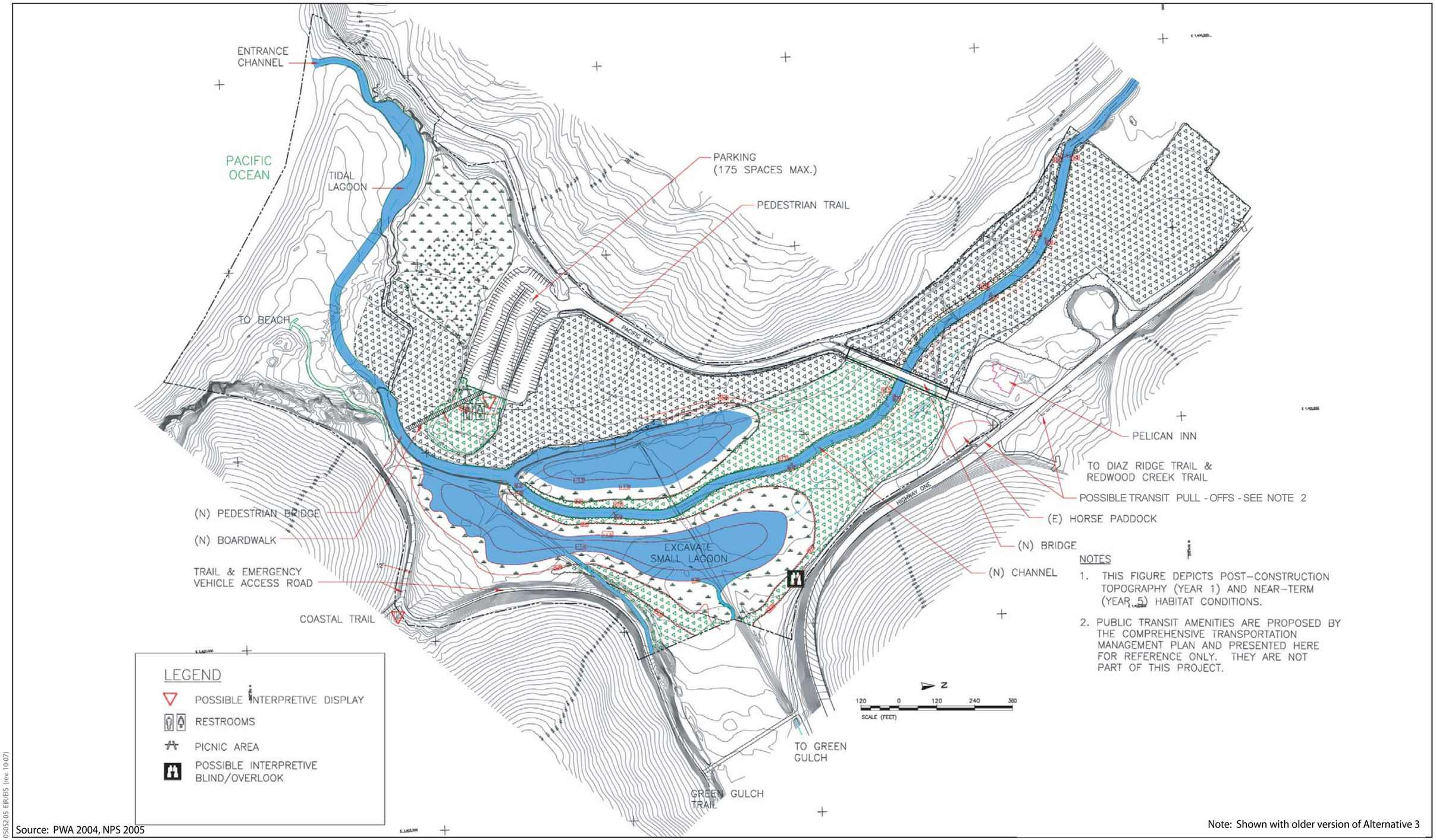
Note: Shown with older version of Restoration Alternative 2

05052.05 EIR/EIS (rev. 11-06)

Jones & Stokes

Figure 2-13
Public Access Alternative B2

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2004, NPS 2005

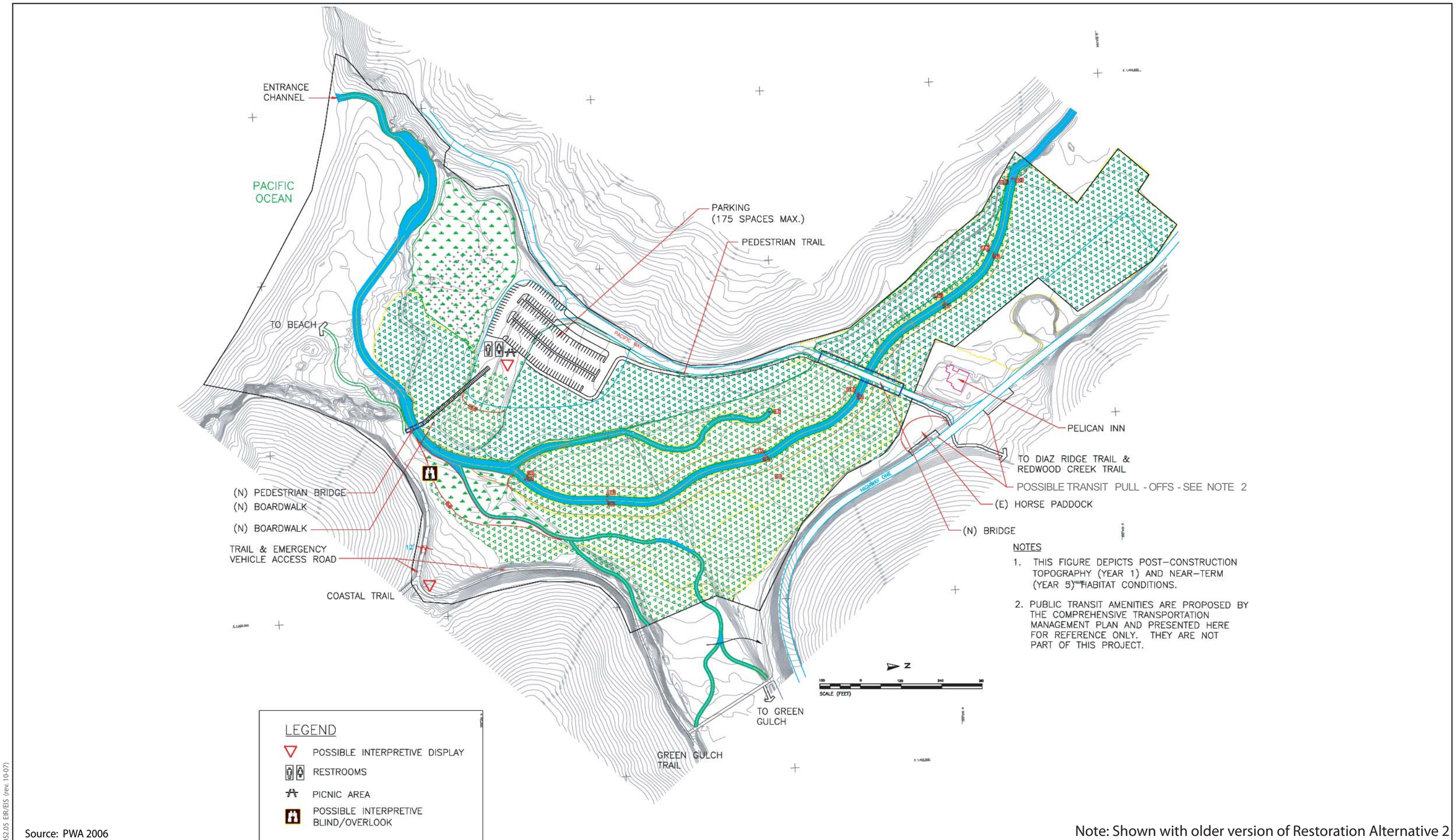
Note: Shown with older version of Alternative 3

05052.05 EIR/EIS (rev. 10-07)

Jones & Stokes

Figure 2-14
Public Access Alternative B3

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2006

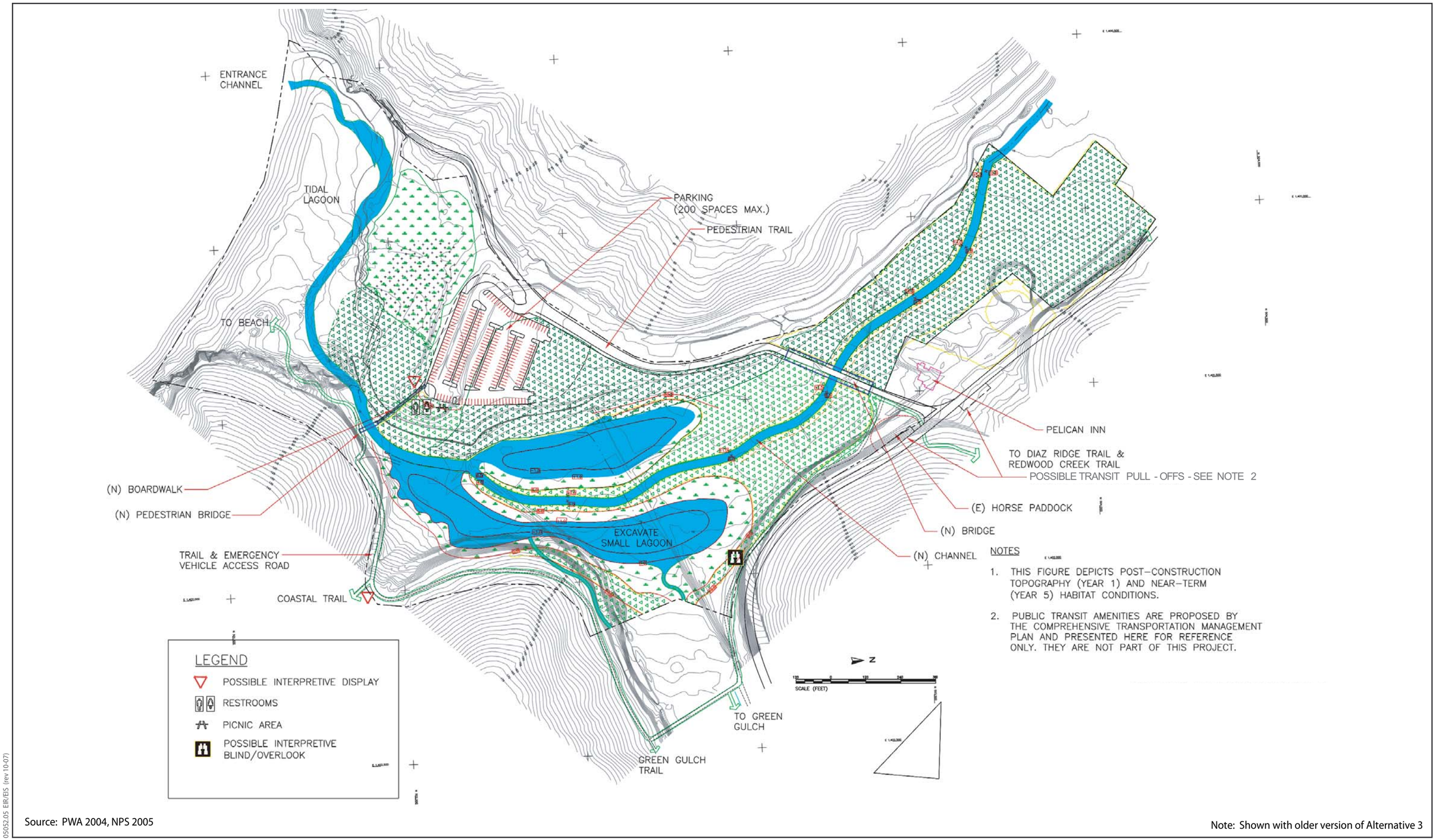
Note: Shown with older version of Restoration Alternative 2

05052.05 EIR/EIS (rev. 10-07)

Jones & Stokes

Figure 2-15
Public Access Alternative B4
Shown with Alternative 2 – Creek Restoration

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2004, NPS 2005

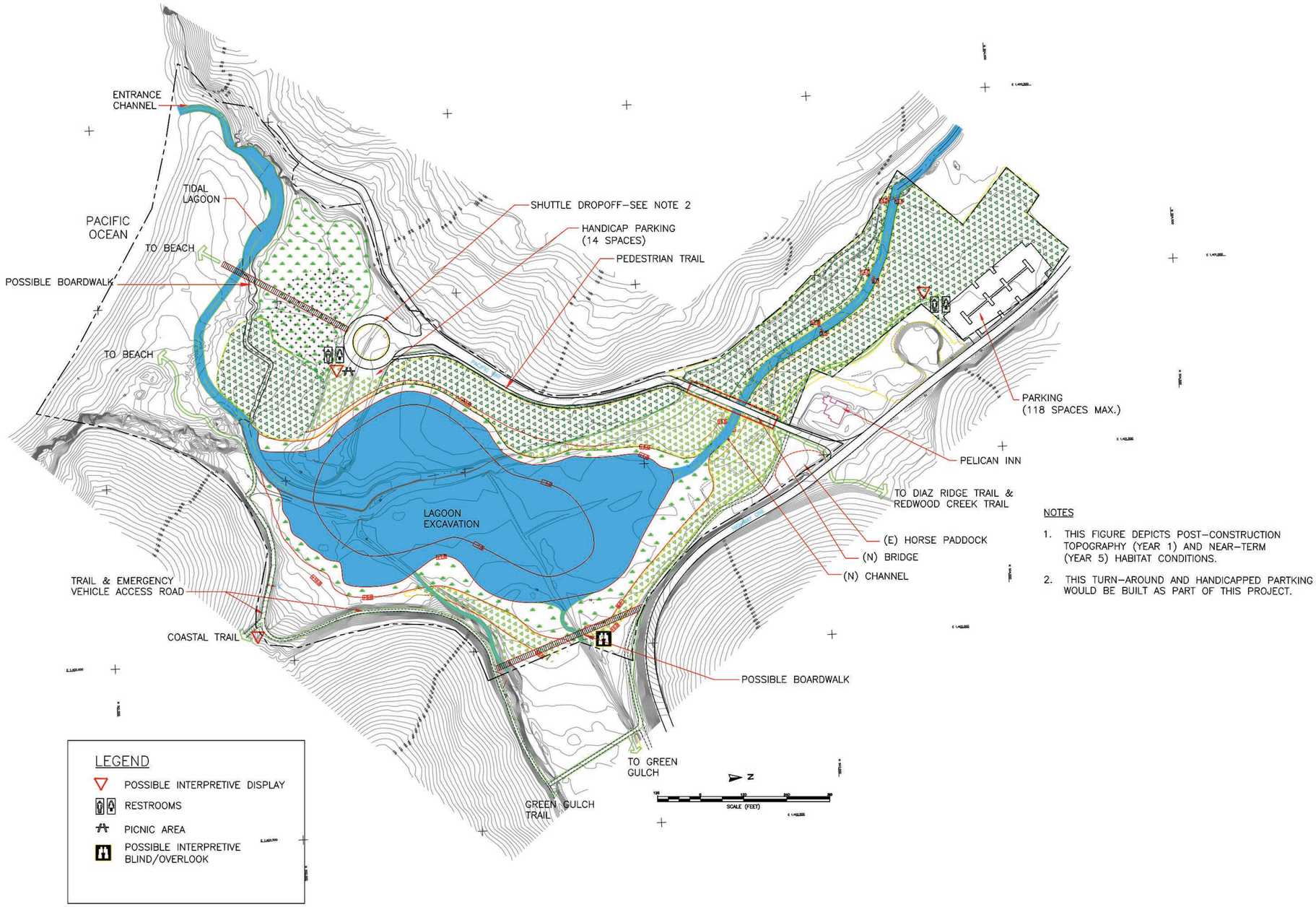
Note: Shown with older version of Alternative 3

05052.05 EIR/EIS (rev 10-07)

Jones & Stokes

Figure 2-16
Public Access Alternative B5

Exhibit 2: Final Environmental Impact Statement



NOTES

1. THIS FIGURE DEPICTS POST–CONSTRUCTION TOPOGRAPHY (YEAR 1) AND NEAR–TERM (YEAR 5) HABITAT CONDITIONS.
2. THIS TURN–AROUND AND HANDICAPPED PARTKING WOULD BE BUILT AS PART OF THIS PROJECT.

Source: PWA 2004, NPS 2005

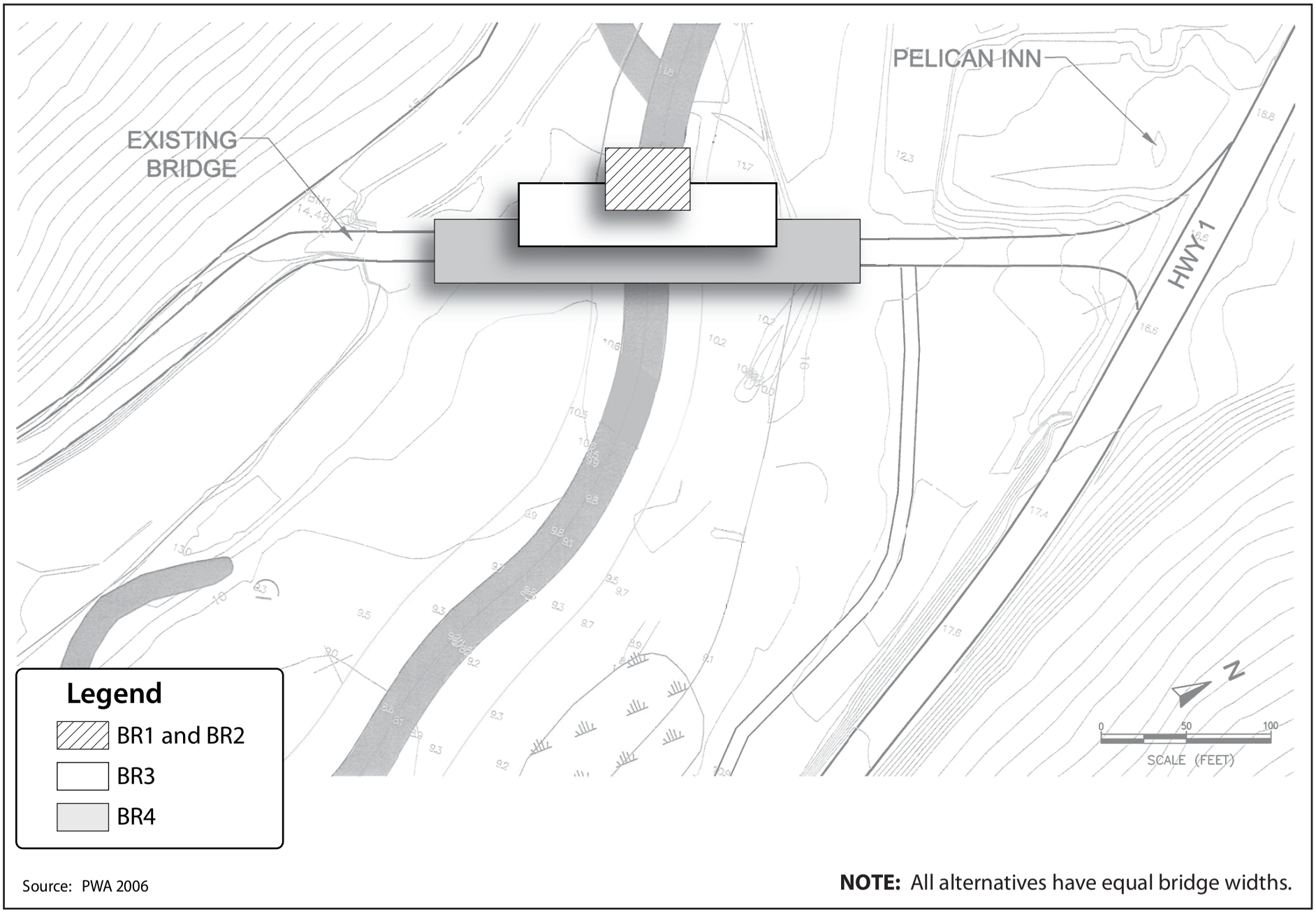
Note: Shown with older version of Alternative 4

05052.05 EIR/EIS (rev 7-06)

Jones & Stokes

Figure 2-17
Public Access Alternative C

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2006

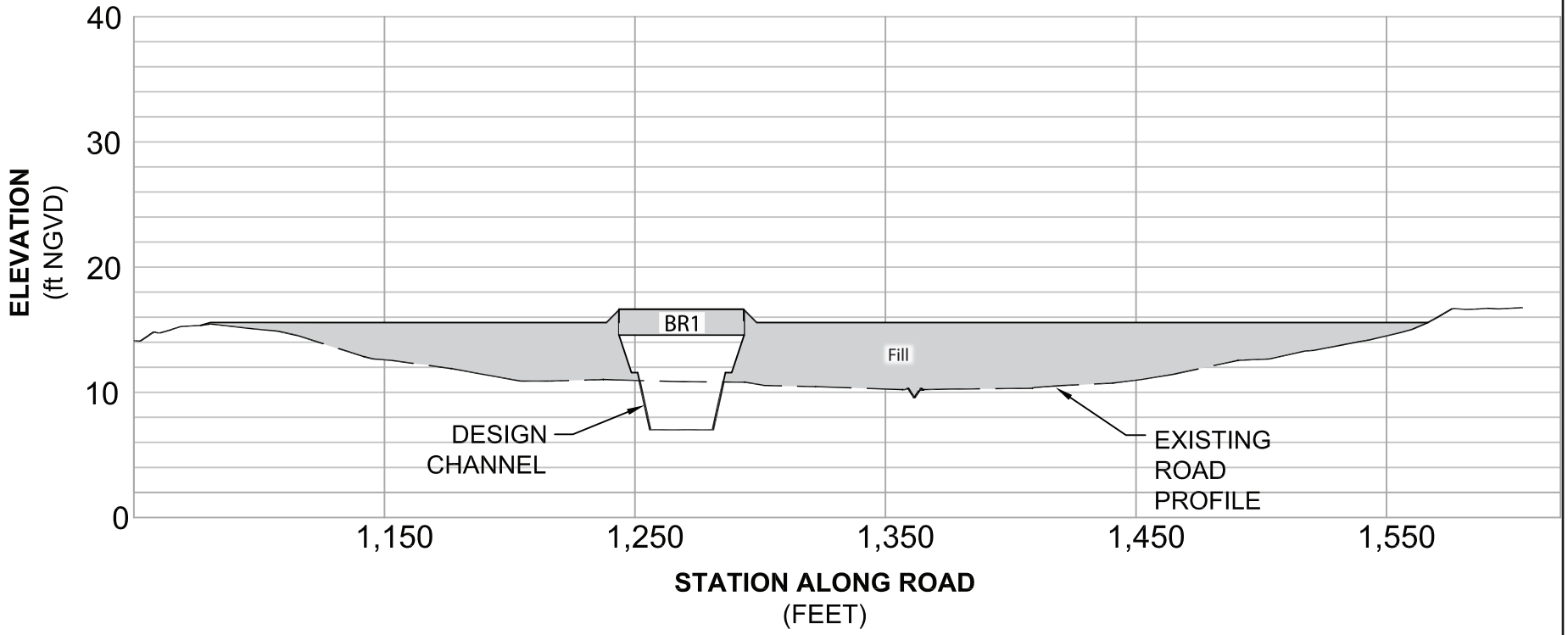
NOTE: All alternatives have equal bridge widths.

05052.05 EIR/EIS (rev 8-07)

Jones & Stokes

Figure 2-18
Bridge Alternatives

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2006

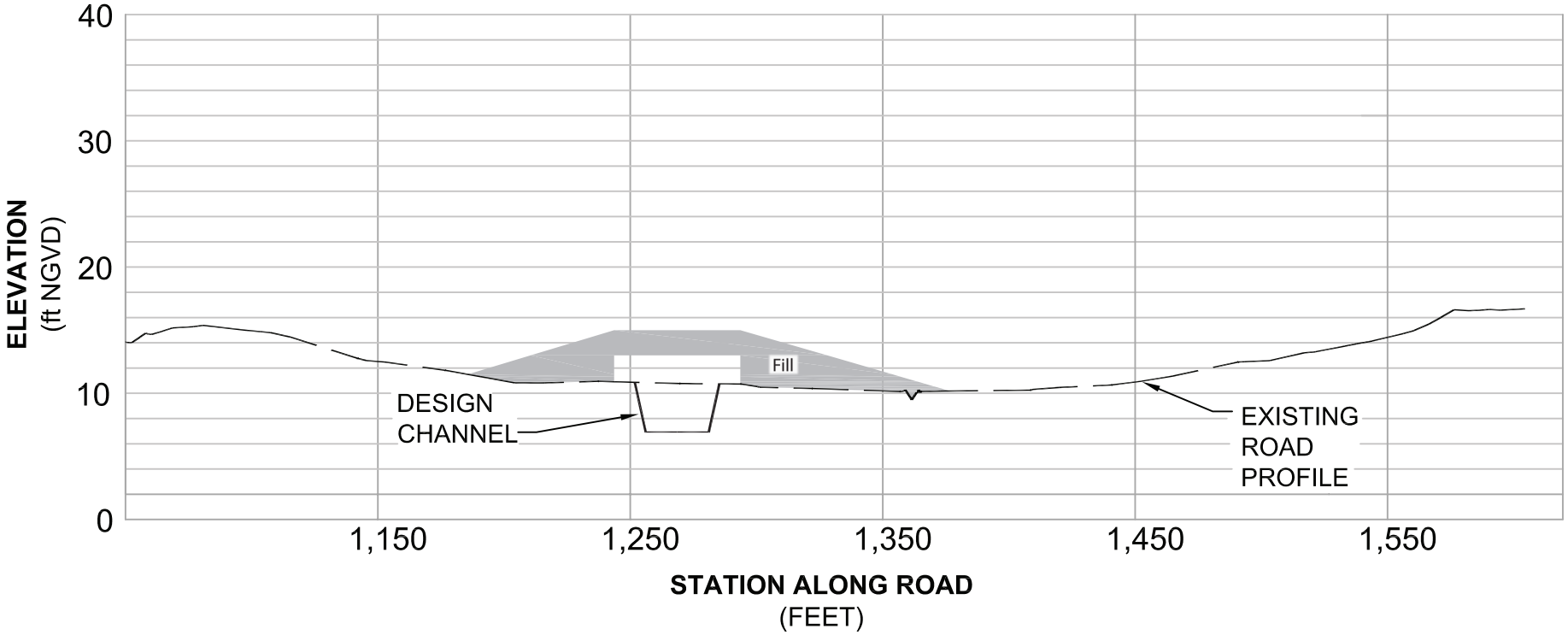
Note: Conceptual design. Does not show bridge supports

05052.05 EIR/EIS (rev.10/06)

Jones & Stokes

Figure 2-19
Bridge Alternative BR1

Exhibit 2: Final Environmental Impact Statement



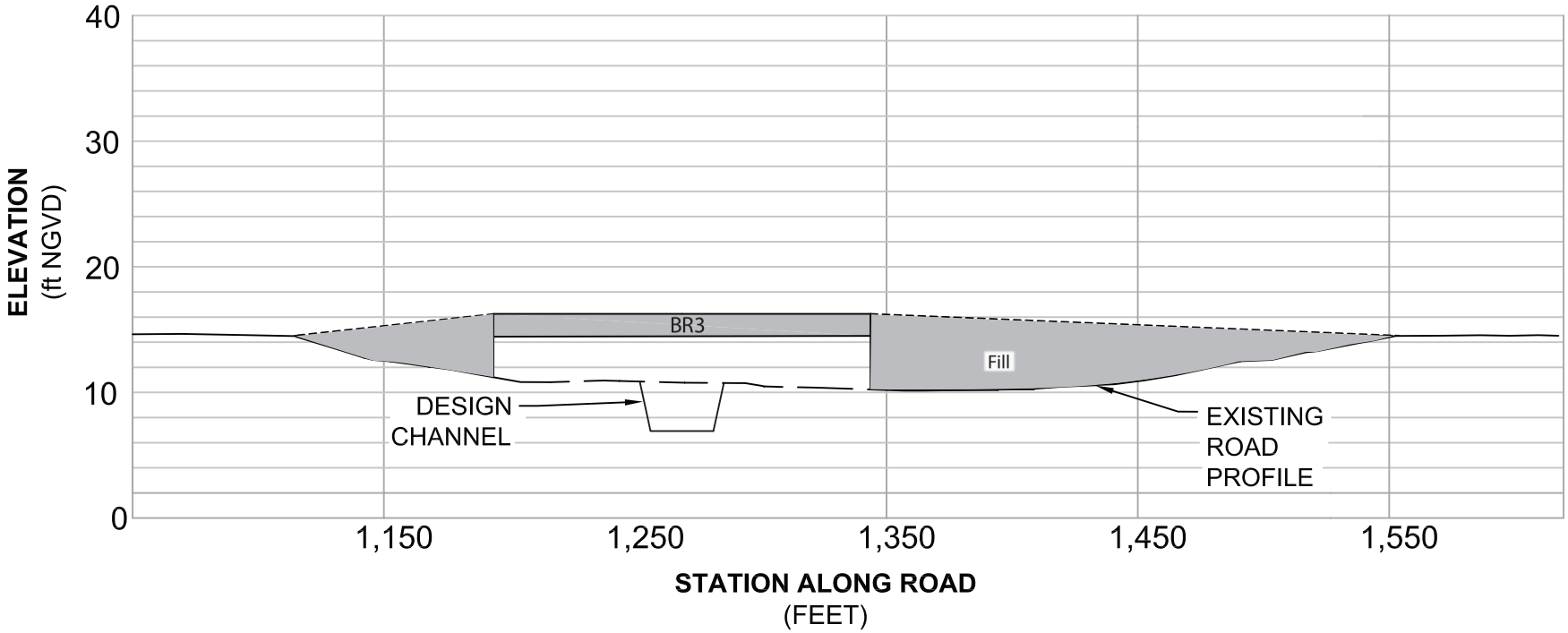
Source: PWA 2006

05052.05 EIR/EIS (rev.10/06)

Jones & Stokes

Figure 2-20
Bridge Alternative BR2

Exhibit 2: Final Environmental Impact Statement



NOTES:
1. THIS IS A SCHEMATIC REPRESENTATION OF THE 150-FT SPAN BRIDGE (AS MODELED). THE ACTUAL DESIGN NEEDS TO INCLUDE TRANSITION FROM THE RAISED ROAD (EL. 14.5 FT) TO THE BRIDGE DECK (EL. 16.25 FT).

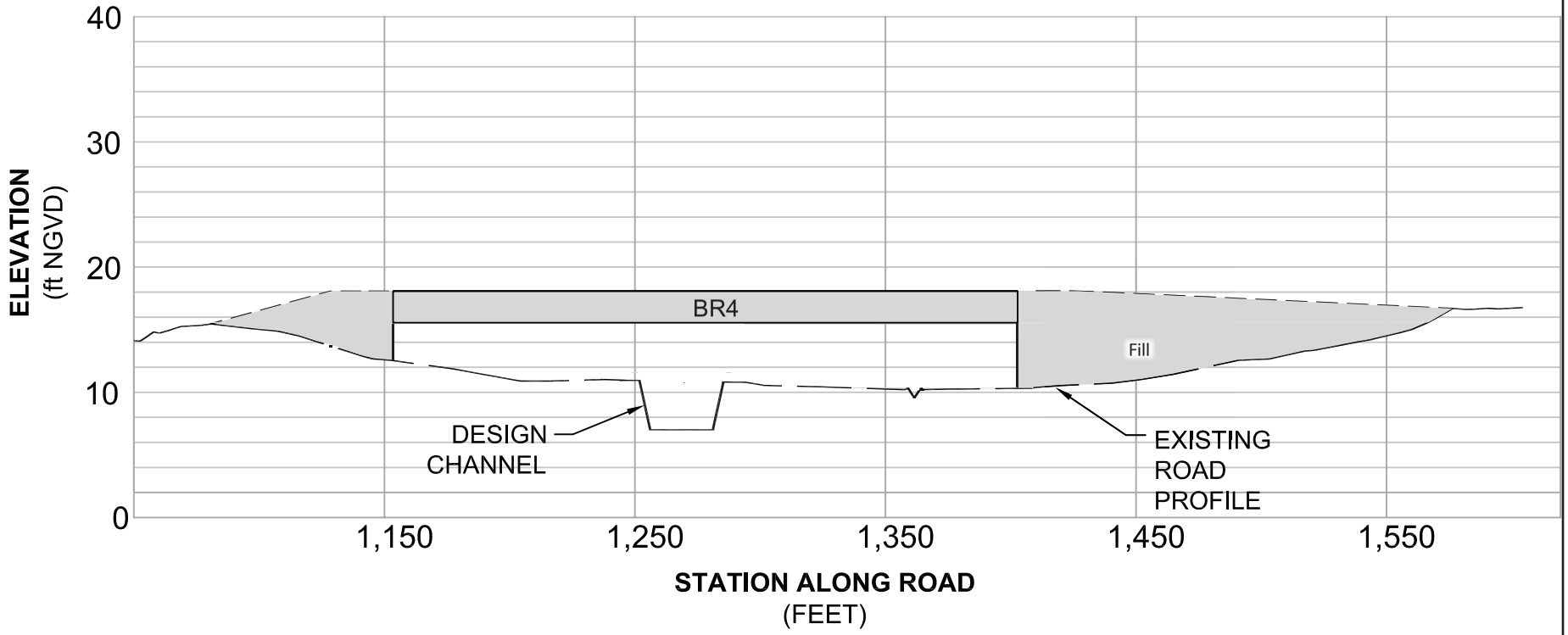
Source: PWA 2006

05052.05 EIR/EIS (rev 10/06)

Jones & Stokes

Figure 2-21
Bridge Alternative BR3

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2006

Note: Conceptual design. Does not show bridge supports

05052.05 EIR/EIS (rev.8-07)

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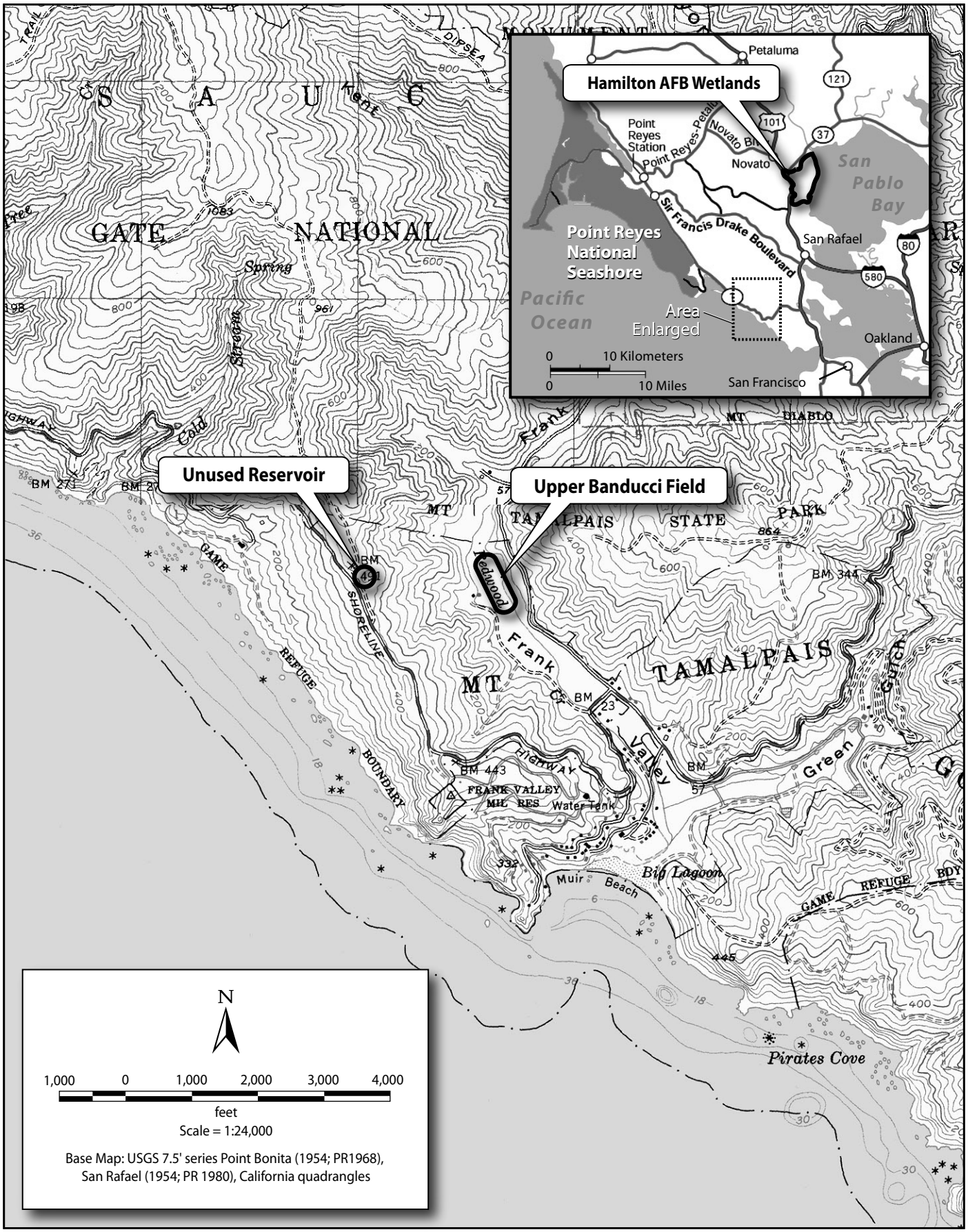
Figure 2-22
Bridge Alternative BR4

Exhibit 2: Final Environmental Impact Statement

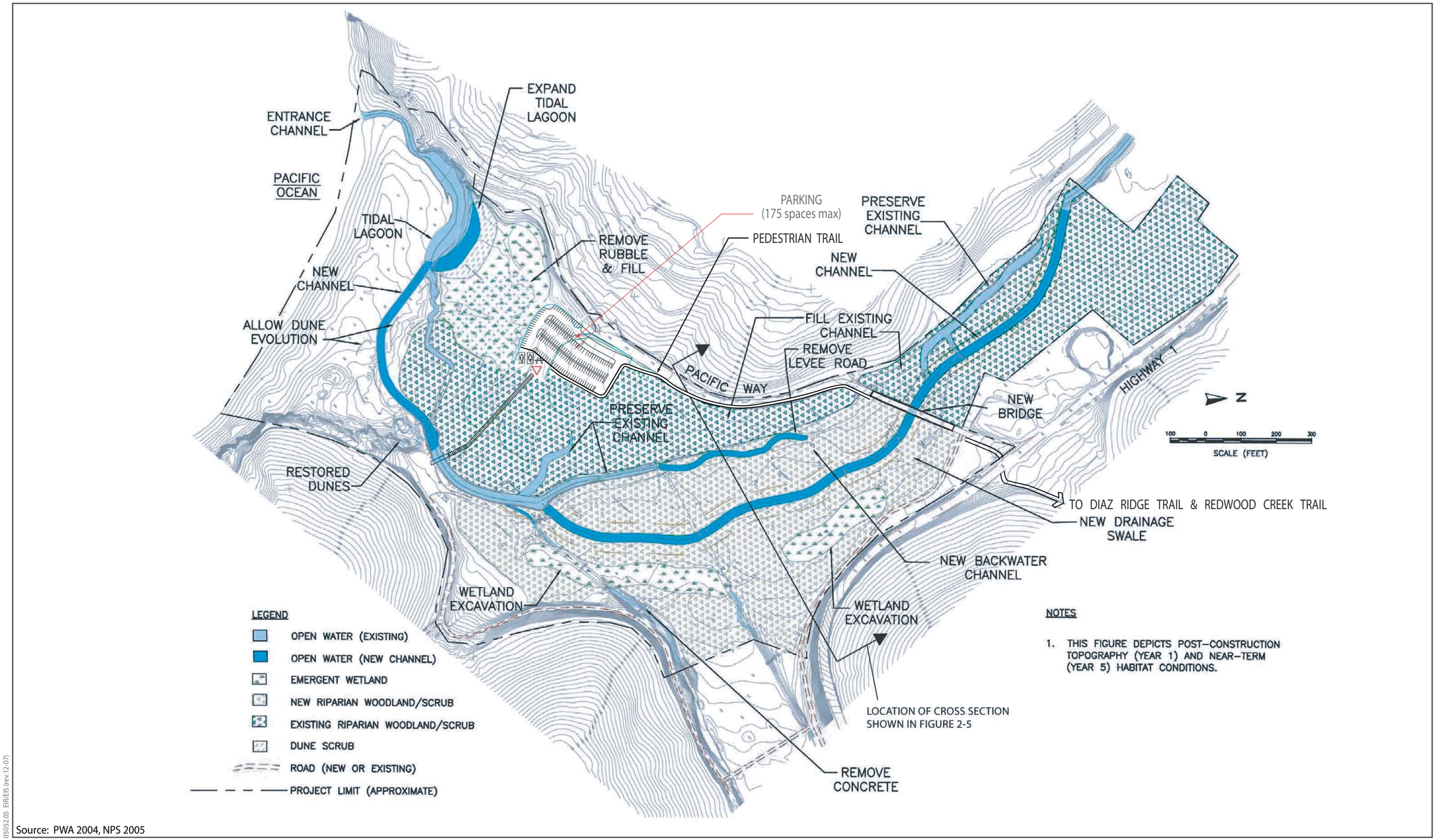


05052.05 ADEIS/EIR (10\06)

Jones & Stokes

Figure 2-23
Fill Disposal Sites

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2004, NPS 2005

05052.05 EIR/EIS (rev.12-07)

Jones & Stokes

Figure 2-24
Preferred Restoration Alternative,
Preferred Parking Alternative, and Preferred Bridge Alternative

Exhibit 2: Final Environmental Impact Statement

Chapter 3

Affected Environment

Exhibit 2: Final Environmental Impact Statement

Chapter 3
Affected Environment

3.1 Physical Resources

3.1.1 Watershed Processes

For the purposes of this document, watershed processes encompass four primary issues: hydrology, flooding, geology/soils/geohazards, and geomorphology. This discussion presents an overview of the major historic and existing watershed processes in the Redwood Creek watershed and at the Big Lagoon site. Watershed functions and processes in the project area have been extensively described in a variety of other documents. Main sources of information describing historic and baseline conditions at the site include:

- The 1994 EA (Philip Williams & Associates et al. 1994)
- The Site Analysis Report (Philip Williams & Associates et al. 2003)
- The Sediment Budget for Redwood Creek Watershed, Marin County, California (Stillwater Sciences 2004)
- The Feasibility Analysis Report (Philip Williams & Associates et al. 2004)
- The Addendum to the Feasibility Analysis Report (Philip Williams & Associates 2004)
- The Draft 2005 Redwood Creek Watershed Assessment (Stillwater Sciences 2005a)

Unless cited otherwise, all of the information below has been distilled from the above reports, and the reader is referred to these documents for a more comprehensive description of site history and conditions.

3.1.1.1 Regional Setting

The 8.9-square mile Redwood Creek watershed is located north of San Francisco, in southwestern Marin County (Figure 1-1). The headwaters of Redwood Creek originate on the southwestern slopes of Mt. Tamalpais. The creek flows through Redwood Canyon into Frank Valley, where the creek and its tributaries enter a relatively broad alluvial floodplain. From Frank Valley, the creek enters the Big

Lagoon site, and then empties into the Pacific Ocean at Muir Beach. Major tributaries in the headwaters include Bootjack, Rattlesnake, Spike Buck, and Fern creeks. Kent Canyon Creek, another major tributary, joins Redwood Creek in Frank Valley. Green Gulch Creek drains the southeastern 1.2 square miles of the watershed, joining Redwood Creek at the Big Lagoon site.

The project site is located at Big Lagoon, at the terminus of the Redwood Creek watershed. Big Lagoon itself is a tiny intermittently tidal lagoon with an open water surface area that fluctuates between 0.1 and 1.7 acres annually (Philip Williams & Associates et al. 2003). This is a fraction of the historic extent of open water habitat on the site. Based on historic maps and sediment cores, the Big Lagoon complex was predominantly a freshwater/brackish marsh consisting of roughly 12 acres of open water, 13 acres of emergent wetlands, and 5 acres of beach dunes (Philip Williams & Associates et al. 2003). From 1853 to the present, a variety of human and accelerated natural processes (including channelization, levee construction, agricultural filling, and parking lot construction) impacted the Big Lagoon environs. Currently 6 feet of fill overlays the historic freshwater lagoon elevation.

3.1.1.2 Watershed Land Use History

The land use history of the Redwood Creek can be roughly divided into four periods, as follows:

Pre-1840

This period was dominated by a combination of natural processes and the influence of Coastal Miwok culture, with human use of fire being a major force shaping the landscape. During this period, upslope sediment production was largely intercepted by deposition in Frank Valley, and some tributaries entering the alluvial valley are thought to have emptied into alluvial fans where the flows percolated and proceeded via shallow subsurface flow to Redwood Creek. This greatly reduced sediment reaching the mainstem of Redwood Creek, resulting in a low sediment yield to Big Lagoon. Figure 3.1.1-1 shows the historic configuration of the Big Lagoon site based on an 1853 U.S. Coast Guard map, and also illustrates Philip Williams & Associates' conceptual model of the key processes driving the site's physical configuration at that time.

1841–1920

This period exhibited the greatest land use change as Euroamerican settlement occurred in the watershed, along with associated forms of site disturbance, such as timber harvest, grazing, and dairy farming. Runoff patterns and sediment production in upslope areas were altered by these changes, increasing sediment discharge and in some cases incising a connection between tributaries and the mainstem of Redwood Creek, as well as incision of the Redwood Creek mainstem itself. These factors resulted in greatly increased sediment yield to Big Lagoon. By 1900, Big Lagoon had mostly filled in, and Redwood Creek in the project area was channelized.

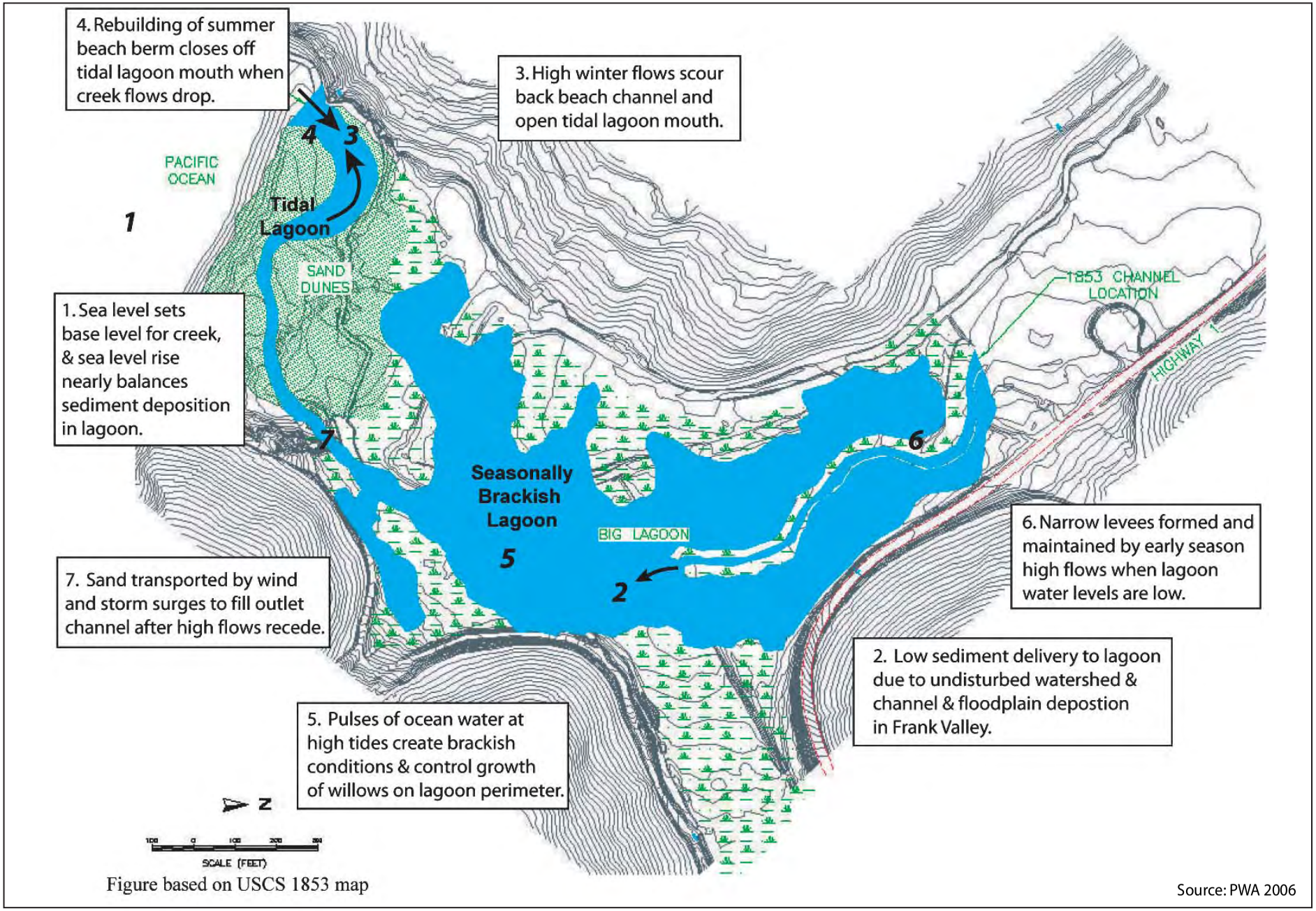


Figure based on USCS 1853 map

Source: PWA 2006

05052.05 ADEIS/EIR (7-06)

Jones & Stokes

Figure 3.1.1-1
Presettlement Conceptual Model

Exhibit 2: Final Environmental Impact Statement

1921–1980

This period was characterized by the greatest creek and watershed disturbance as the land use practices identified above intensified, in particular grazing and dairy farming. As a result, changes initiated under the previous period intensified and further elevated sediment yields to the Big Lagoon site. Residential development expanded in the watershed, centered at the existing Muir Beach community. The levee upon which the levee road current resides was built in the 1940s, and fill was brought into the site from upslope areas to raise the pasture for grazing purposes.

1981–Present

This period represents a shift towards watershed protection and active in-channel conservation measures, whereby upslope processes have begun recovery toward predisturbance conditions, but in which the legacy of human disturbance in the channel network continues to elevate sediment yield to Big Lagoon. The watershed during this period has come under mostly public ownership, preventing further large-scale watershed disturbance from agricultural and resource extraction activities. The visitor parking lot was extended and filled early in this period, which has also been characterized by rapid channel aggradation and flooding at the Big Lagoon site. Figure 3.1.1-2 shows the recent configuration of the Big Lagoon site, and illustrates Philip Williams & Associates' conceptual model of the key processes driving the site's current configuration. Figure 3.1.1-3 illustrates Philip Williams & Associates' conceptual model of the key processes anticipated to drive the site's future configuration.

Table 3.1.1-1 further describes major watershed disturbances and hypothesized sediment transport responses.

Table 3.1.1-1. Major Watershed Disturbances and Hypothesized Sediment Transport Responses

Period	Time Period	Characteristics and Activities	Hypothesized Sediment Response
Coast Miwok	7,000 before present –1840	• Oak woodland and meadow floodplain with grassland on hillslopes, maintained by burning • Redwoods in canyons and valley • Upland prairies maintained by natural fires • Riparian fringe along Redwood Creek. • Big Lagoon is lagoon-like, at least seasonally	• Low sediment production, primarily of fine sediment by creep and biogenic processes • Shallow landslides during storm events. • Sediment supply to mainstem channel may be low due to lack of connection to Frank Valley tributaries • Tributary fan deposition and overbank flooding in non-incised channel allows sediment storage and valley alluviation
Euroamerican Arrival and Resource Development	1841–1920	• Lower valley: removal of floodplain woodland, introduction of extensive then intensive grazing and dairy farming, replacement of native perennial grasses with annual exotics	• Reduced tree cover and grazing causes greater volumes and flashy storm flows • Replacement of native grasses with non-natives provides less effective resistance to erosion

Period	Time Period	Characteristics and Activities	Hypothesized Sediment Response
		• Logging of redwoods, late in Redwood Creek due to its relative inaccessibility, soil stripped for clay following logging • Construction of first roads, trails, trains, tourism, triggering of accidental fires • Riparian fringe along Redwood Creek removed, possible local realignment of lower Redwood Creek near Pacific Way • Levees, conversion of Big Lagoon to pasture • Muir Woods National Monument established to save "last remaining redwoods"	• Both factors combine to increase tributary sediment yields, increase tributary connectedness during high flow events and initiate incision of the channel mainstem. • Incision confines flows, reverses former sediment storage and increases sediment yields further; incised channel capable of transporting coarser sediment
Engineering as Management	1921–1980	• Riparian flower and hay farming • Early period of tourism with tavern at Muir Beach and summer cottages (beginning in 1920s). • Pacific Way road and bridge built; creek realigned to fit bridge • Progressive transfer of farms to State and National Parks (1960s–1980). • More exotics (eucalyptus, heather). Tree removal firebreaks, fires suppressed. • Logging of 1,300 acres (Kent Canyon, 1960s) • Muir Woods infrastructure created; parking lots through cut and fill, further trails constructed. • Roads upgraded, Hwy 1 embankment effectively dams lower watershed. • Local water extraction in Frank Valley for irrigation and Muir Beach community. • Redwood Creek in Muir Woods extensively "protected" by riprap and grade control, straightened, LWD removed. • Redwood Creek in Frank Valley locally realigned for roads/bridges (assumed), leveed, subject to small-scale gravel extraction, floodplain leveled and cut off from most flooding at Banducci farm. • Redwood Creek in Big Lagoon dredged, dammed (then dam removed), leveed, Green Gulch channelized, fill placed in Green Gulch pasture, reservoirs constructed,.	• Continuation of previous trends; potential decrease in tributary sediment production as former farmland is converted to parkland, but increases due to riparian farming, from Kent Canyon, due to logging, from Muir Woods due to addition of roads and trails • Engineering measures halt incision in Redwood Canyon but may cause greater flashiness of flows • Sediment production may increase in lower watershed as channels are straightened and leveed • Most sediment production from Green Gulch intercepted by reservoirs • Effective depositional area in Big Lagoon reduced by levees and fill

Period	Time Period	Characteristics and Activities	Hypothesized Sediment Response
Recovery and Restoration	1981–2002	• Land use conversion from grazing to park land. Most of watershed publicly owned; exotic grasslands, forested tributaries, pines in upper watershed. • Prescribed burn experiments. • Irrigation of Green Gulch pasture from Redwood Creek at site ends, followed later by end of water diversion from the creek at Banducci Flower Farm. • Fill placed to raise and extend parking lot at Muir Beach. • Muir Beach Community Services District obtains state water rights for well upstream of Muir Beach. • Riparian and LWD recovery. • Terrestrial wetland species invade Big Lagoon.	• Tributary sediment sources other than from roads and trails may begin to wane as agriculture ceases. • Increasing roughness of mainstem channel as LWD volume increases may act to trap greater sediment volumes. • Continuation of reduced area for sediment deposition in Big Lagoon and interception of Green Gulch sediments

Source: Stillwater Sciences 2004.

3.1.1.3 Hydrology

Climate and Precipitation

The Redwood Creek watershed, on the western slope of Mt. Tamalpais, is characterized by a Mediterranean climate with mild, wet winters and mild, dry summers. Though the region has a two-season Mediterranean climate, the Redwood Creek watershed is strongly influenced by the cool and moist maritime air masses. In the summer season, this moist air is advectively cooled to saturation over the cold surface waters of the California current. This process results in heavy fog over the watershed in the summer season.

Rainfall is measured at Muir Woods, and averages 37.5 inches annually. Fog is significant and can contribute up to 10 inches of precipitation annually. The vast majority (95 percent) of annual precipitation occurs between October 1 and April 30. Average rainfall by month is shown in Table 3.1.1-2.

Table 3.1.1-2. Mean Monthly Precipitation at Muir Woods

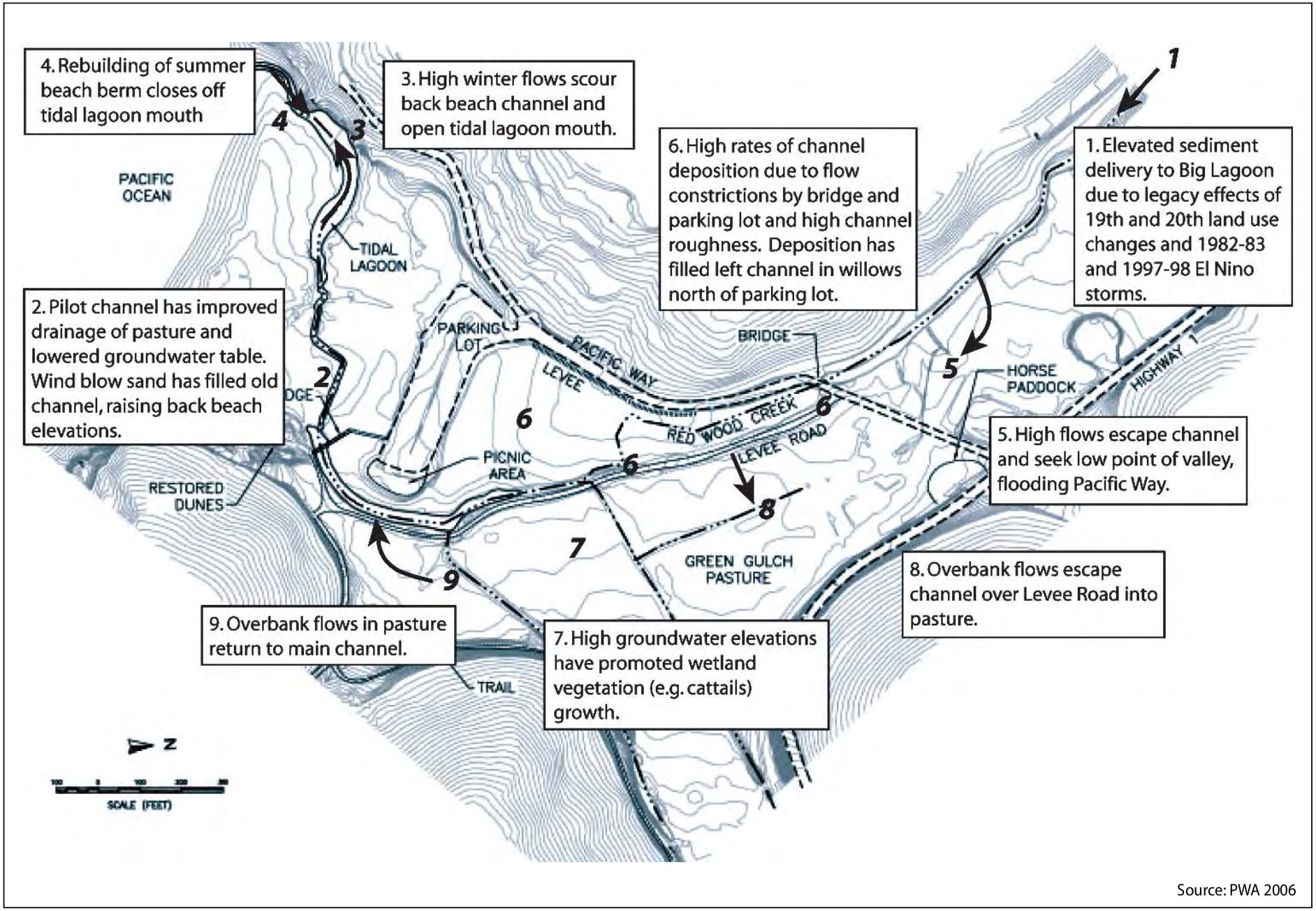
Month	Mean Monthly Precipitation (inches)
January	7.7
February	6.2
March	4.9
April	2.4
May	1.1
June	0.4
July	0.1
August	0.1
September	0.4
October	2.0
November	5.3
December	7.3
TOTAL	37.9

Source: Philip Williams & Associates et al. 2003.

Redwood Creek Streamflow

The hydrologic regime of Redwood Creek is similar to that of many northern California coastal streams. Early season storm flows are comprised primarily of direct storm runoff and recede quickly after rainfall ends. By January, in average or wet years, groundwater storage is sufficient to maintain high baseflows, and post-storm recessions can last for over 7 days. Flows in the late spring and summer dry season are derived from groundwater and springs in the upper watershed. Limited groundwater storage is available in the alluvial deposits in the lower valleys, and during the dry season the creek commonly loses water to groundwater in the lower reaches in Frank Valley. By the end of the summer dry season, the creek can have virtually no surface flow. Discussion of “low-flow hydrology” in Chapter 4 refers to these conditions during the dry season.

The estimated peak flood recurrence relationship for Redwood Creek at the Hwy 1 Bridge is shown in Figure 3.1.1-4 and Table 3.1.3-3. Stream flow records for the watershed are discontinuous, with the largest data gap between the early 1970s and late 1980s. Even with the recent addition of nearly seven years of semi-continuous flow measurements, the stream gauging history of Redwood Creek is too short and sporadic for development of a reliable long-term flow-duration curve for peak floods. In an attempt to overcome this limitation, Redwood Creek flow data have been combined with extrapolative analyses of hydrologic data from neighboring watersheds. A statistical analysis of that data



Source: PWA 2006

05052.05 ADEIS/EIR (7-06)

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Figure 3.1.1-2
Existing Conceptual Model

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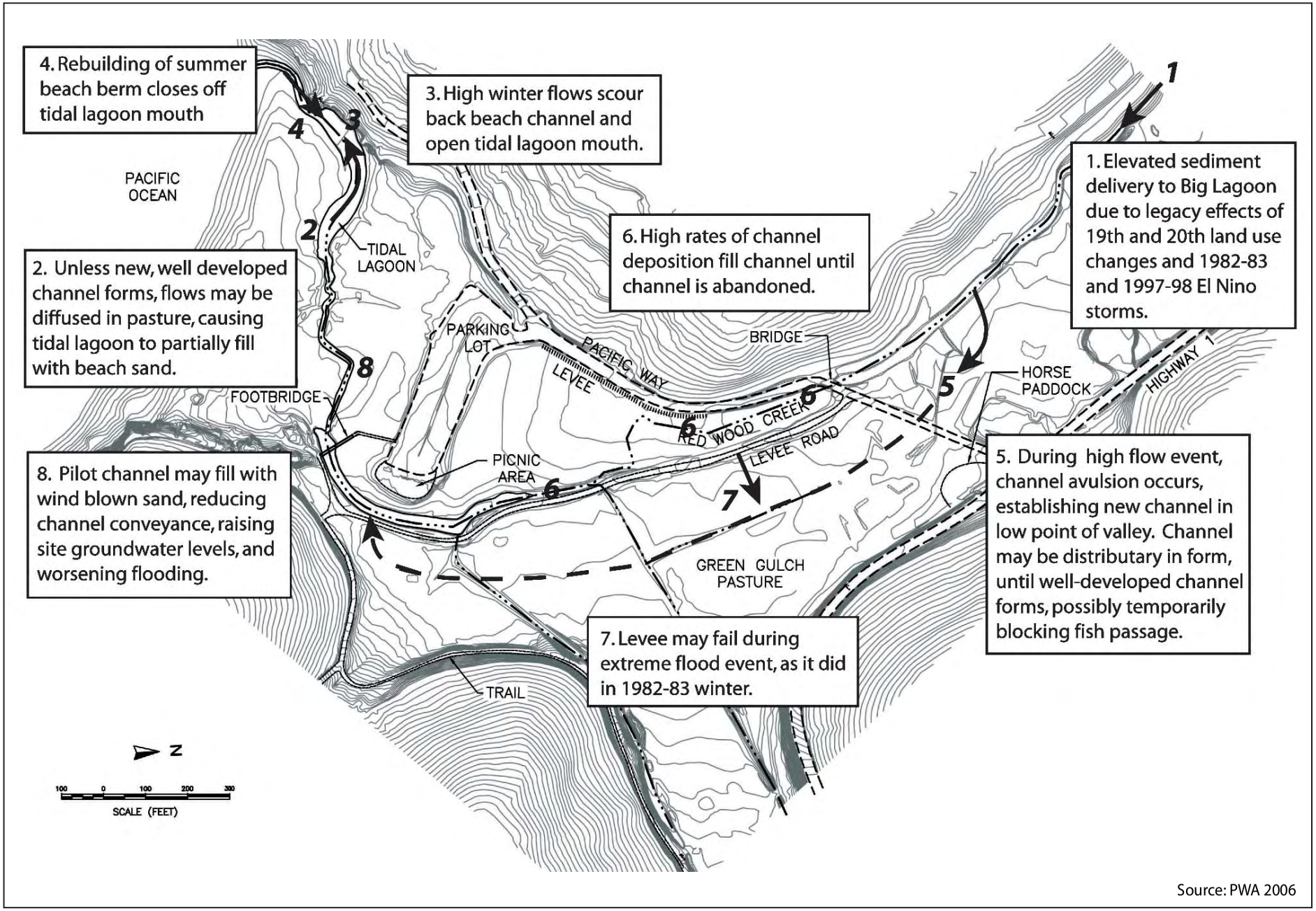

Source: PWA 2006

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Figure 3.1.1-3
Future Conditions Conceptual Model

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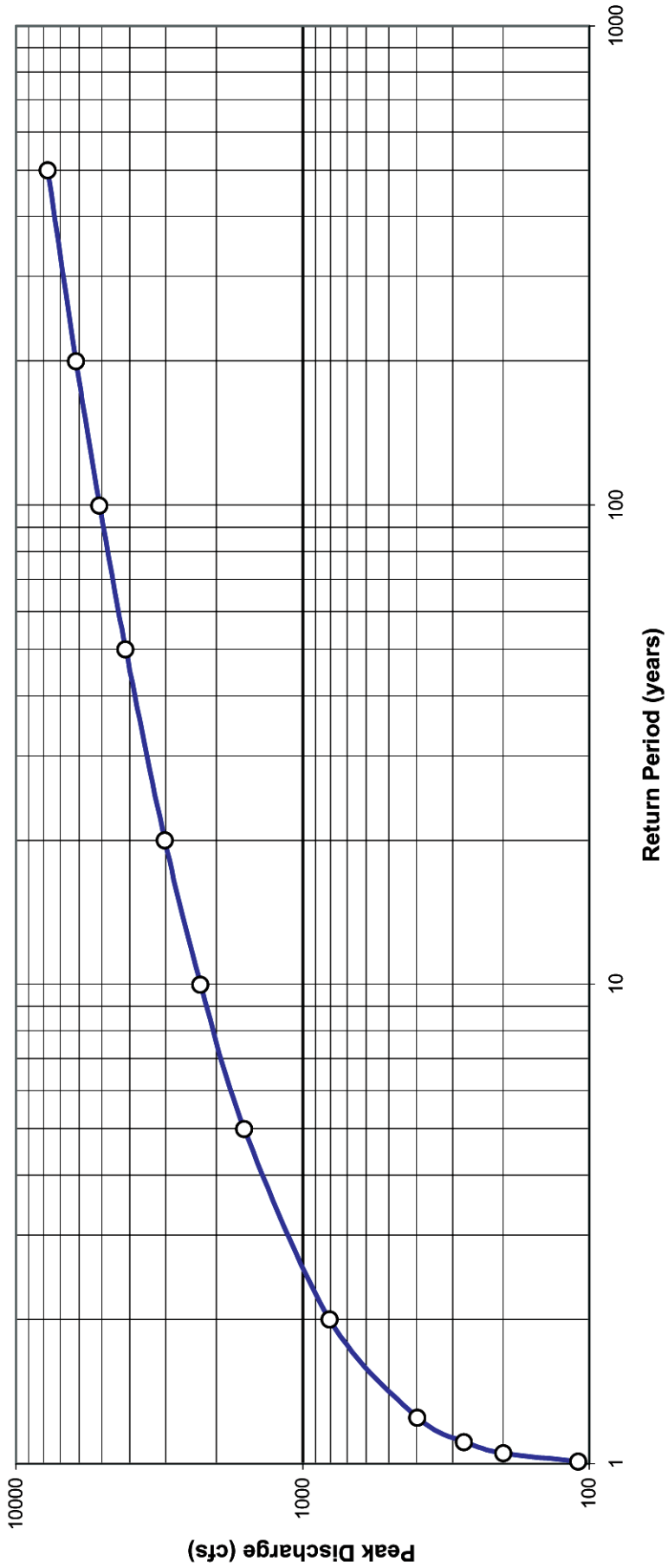

Source: PWA 2006

Figure 3.1.1-4
Flow-recurrence Curve

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yielded the peak flow recurrence relationship displayed in this Final EIS/EIR. Uncertainties in the flood magnitudes, while difficult to quantify precisely, are undoubtedly very high, due to the extrapolative methods that were used to generate the relationship. More recent empirical data, such as flow volumes for the New Year's storms of 2005/2006, have not been incorporated into estimates to date, but are not anticipated to substantially alter the estimates of flood recurrence intervals. For a more complete discussion of streamflow records, as well as stage-discharge relationships, please refer to Stillwater Sciences (2005) and Philip Williams & Associates et al. (2003.)

Table 3.1.1-3. Estimated Peak Flood Recurrence Relationship for Redwood Creek at the Hwy 1 Bridge

Annual Peak Flood Recurrence Interval (years)	Flow (cfs)
2	805
5	1,600
10	2,270
25	3,270
50	4,140
100	5,100

Source: Philip Williams & Associates et al. 2003.

Flow Diversions

Water is diverted from Redwood Creek and its tributaries by the Marin Municipal Water District (MMWD), Green Gulch Farms, and the MBCSD. Green Gulch Farms has developed an elaborate system of reservoirs to store and divert flow from Green Gulch Creek and its tributaries for irrigation, stock watering, fire protection, recreation, and domestic use.

MBCSD operates a well on the Redwood Creek floodplain near the Banducci property, approximately 2.5 miles upstream of the Big Lagoon site, and is permitted to withdraw up to 50.6 acre-feet per year of underflow from Redwood Creek. Groundwater levels and surface flow in Redwood Creek at the project site are affected by MBCSD well operation. Operation of the MBCSD well is believed to induce infiltration from Redwood Creek to the alluvial aquifer, with streamflow depletion accounting for 70–80 percent of the pumping rate of the well. Groundwater modeling concluded that the MBCSD pumping decreased instantaneous downstream flows in Redwood Creek by as much as 0.09 cfs. This decrease in flow is primarily significant in the late dry season, when flows are naturally on the order of 0.1 to 0.2 cfs. Lower Redwood Creek completely dries up naturally approximately once every 4 years; however MBCSD pumping may increase this frequency to approximately once in 3 years. (Philip Williams & Associates et al. 2003.)

For a more complete description of water diversions and water rights, please refer to Section 3.1.3, *Water Supply*.

Flooding

The alluvial valley at Big Lagoon is the floodplain for Redwood Creek, and the majority of the Big Lagoon site is classified by the Federal Emergency Management Agency (FEMA) as being within the inundation area of a 100-year flow event, as shown on Figure 3.1.1-5. As part of this system's natural functioning, flows that exceed the channel capacity of the creek spread out onto this floodplain. In unmodified systems analogous to Redwood Creek, such out-of-bank flows typically occur during the approximate 1.5 to 2-year recurrence interval flow event. However, due to anthropogenically induced sediment deposition, channel aggradation, and subsequent loss of channel conveyance, flows now escape the lower Redwood Creek channel below Hwy 1 on a more frequent basis (several times per winter). Redwood Creek has not occupied the low point of the valley since being realigned along the western edge of the valley in the early part of the 20th century, and so out-of-bank flows naturally concentrate in the low point and flood Pacific Way near the Pelican Inn. During moderate to large flow events, most of Green Gulch pasture is inundated, and floodwaters approach the elevation of the Muir Beach parking lot as flows converge at the south end of the pasture towards the beach. Photos of flood conditions at the site are presented in Figure 3.1.1-6. During many of these events, Pacific Way is not passable by vehicles.

Flood reduction actions were implemented in 2002 by Marin County and NPS, and in 2004 and 2005 by NPS to improve channel conveyance and reduce the frequency of out-of-bank flow. The 2002 actions included:

1. removing sediment from 460 feet of the creek in the vicinity of the Pacific Way Bridge,
2. removing approximately four woody debris jams from the creek,
3. excavating a 300-foot-long pilot channel through a sediment deposit that had closed off the mouth of the creek,
4. constructing two armored dips in a levee road to provide hydraulic connectivity while reducing erosion of the levee,
5. removing a flap gate in a levee culvert to facilitate flood routing from the wetland area to the Pacific Ocean,
6. removing dead trees at risk of falling into the channel, to reduce the likelihood of future obstruction,
7. installing biotechnical bank protection (willow mattresses) upstream of the Pacific Way Bridge to prevent enlargement of floodplain channels,
8. excavating a small trench at the low point on Pacific Way east of the Pacific Way Bridge, and

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Figure 3.1.1-5
FEMA Flood Zones

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View of Pacific Way from Highway 1

View of Muir Beach parking lot from pedestrian bridge to beach

05052.05 ADEIS/EIR (7-06)

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Figure 3.1.1-6
Photos of Flood Conditions

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9. Placing logs at key points that would not obstruct flows but would provide some salmonid habitat.

Flood reduction actions in 2004 were conducted when the channel was dry and consisted of excavating about 120 cubic yards of fine sediment and two large log jams from about 300 linear feet of the right-fork channel through the riparian area next to the parking lot. This action restored the right channel as the primary low-flow channel. A log jam in the left-fork channel adjacent to the levee road was also removed. The 2005 flood reduction actions did not involve work in the low flow channel. About 4,275 square feet of the fill pad that functioned as the picnic area was removed in order to increase the floodplain area available for the passage of high flows. This action increased the floodplain cross-section from 35 feet to 94 feet at the upstream end and from 35 feet to 62 feet at the downstream end of the excavation area. In 2005, a log jam on the bank, which obstructs high flows, but not low flows, was also removed in the riparian area adjacent to the parking lot.

While no quantitative assessment of the effects of the 2002 actions on the magnitude and duration of out-of-bank flows has been completed, the actions are believed to have substantially reduced inundation duration on Pacific Way during the winter of 2002/2003 (Vick pers. comm.). The flood reduction actions in 2004 and 2005 appeared to have similar benefits. More recent sediment deposition in the reach immediately downstream of the Pacific Way Bridge and extending upstream toward the Hwy 1 bridge have caused channel profiles to approach pre-2002 conditions. This potentially results in flooding conditions of Pacific Way that is more similar to prior conditions. Refer to Philip Williams & Associates et al. (2003), Philip Williams & Associates (2005), and Appendices D and E to view figures showing surveys of the channel thalweg in Redwood Creek over time.

Extensive flood modeling at the site has been performed by Philip Williams & Associates. The methodology for this modeling is described in the methodology portion of the *Environmental Consequences* chapter (Section 4.3.1.1, *Watershed Processes*), and in more detail in relevant Philip Williams & Associates technical documents (Philip Williams & Associates et al. 2004; Philip Williams & Associates 2005; Appendix D and Appendix E). This modeling has evaluated water elevations during the 5-year, 10-year, 50-year and 100-year event, with the most recent modeling addressing the 10-year and 100-year events (Appendix D). The modeling presented in Appendix D includes more recent topographic data, refined channel and floodplain roughness values, and refined assumptions regarding the existing Redwood Creek channel. This updated modeling is considered a reasonable representation of flood conditions. However, such hydraulic modeling results should be considered approximate, and used for the primary purpose of providing a relative comparison between existing conditions and various hypothetical scenarios.

Flood elevations throughout the project reach during the 5-year, 50-year and 100-year flow events are presented in the *Environmental Consequences* chapter (Figures 4.3.1-1, 4.3.1-2, and 4.3.1-3). Figure 3.1.1-6 shows the Pacific Way road

surface compared to modeled 10-year and 100-year flood elevations. This figure shows how Pacific Way is flooded between Hwy 1 and the Pacific Way Bridge, as well as on portions of the stretch between the Pacific Way Bridge parking lot, during 10-year and greater events. As discussed above, events smaller than the 10-year flow also inundate Pacific Way in these locations, causing significant inundation between Hwy 1 and the Pacific Way Bridge several times per winter.

Spot elevations at Pacific Way and various points upstream were surveyed to compare to modeled flood elevations. The modeled 10-year flood elevation ranges from approximately 15 feet NGVD at the Pacific Way Bridge to nearly 21 feet NGVD at the Hwy 1 bridge. The modeled 100-year flood elevation ranges from approximately 17 feet NGVD at the Pacific Way Bridge to nearly 22 feet at the Hwy 1 bridge. Based on modeling and spot elevation data, it is likely that the finish floors of the two homes on Lagoon Drive (14.9, 15.0 NGVD) and the next home upstream on Hwy 1 (17.8 NGVD at backdoor threshold) are subject to inundation during the 10-year and possibly smaller events. The Pelican Inn finish floor (17.6 NGVD) may be located above the modeled 100-year flood elevations, although only marginally so. Other associated features that are lower in elevation, such as the Pelican Inn parking lot (12.4 NGVD) and steps, and features of the homes that are below the finish floor elevation, would be inundated during more frequent flow events.

Groundwater

The alluvial aquifer in Frank Valley is an alluvial aquifer that is hydrologically connected with surface flow from Redwood Creek. Groundwater data collected in the Green Gulch pasture indicate that groundwater elevations range from approximately 4 feet NGVD at the end of the dry season (September and October) to approximately 8–9 feet NGVD towards the end of the rainy season (February through March). During the dry season, groundwater levels at the Big Lagoon site are set by mean high tide (approximately 3 feet NGVD) and the Redwood Creek thalweg near the beach (approximately 4 feet NGVD). At the onset of the rainy season, as flows in Redwood Creek increase, groundwater levels rise from this minimum elevation until they are close to the ground surface from January through April. Groundwater levels during this period follow the surface topography, with the highest elevations in the upper Green Gulch pasture. Throughout late spring into summer, levels decrease at a rate of about 0.5–1 feet per month through the summer, with the highest water levels adjacent to the levee, as groundwater flows from the upper pasture areas towards the lower pasture. The effects of upstream pumping about 1 mile upstream of the site by MBCSD on groundwater levels have been described under *Flow Diversions*, above.

Saltwater from the ocean is prevented from intruding into the freshwater aquifer as a result of the channel at the downstream end of the Big Lagoon site (downstream of the pedestrian bridge). The channel thalweg in this reach is approximately 4 feet NGVD, and effectively sets groundwater levels during the dry season. Because the tidal range does not extend above this elevation, an

effective barrier exists to saltwater migration further inland. Periodic saltwater overwash as a result of high tides and winter storm-induced waves does not substantially affect groundwater salinity.

3.1.1.4 Geology and Geomorphic Processes

Geology and Soils

The Marin Headlands are part of the California Coast Ranges, which were formed over the last several million years in response to crustal shortening associated with compression between the Pacific and North America tectonic plates (Wahrhaftig 1994). Most of the Redwood Creek watershed is underlain by rocks of the Franciscan accretionary assemblage, a highly deformed mixture of sedimentary, metamorphic and igneous rocks of late Jurassic and Cretaceous marine origin (Wahrhaftig 1994; Blake et al. 2000). Incoherent shale and sandstone dominate, with slopes that tend to be highly susceptible to landsliding and debris flows.

In the lower parts of the watershed, surface soils are clay-loams that give way to clay at depth, and ultimately to bedrock. The Frank Valley floor consists of Quaternary alluvial fill, which presumably accumulated in response to rising base level associated with sea level rise over the last 10,000–15,000 years. Alluvial deposits also occur the lower part of Green Gulch Creek, above Big Lagoon. Alluvial deposits are dominated by fine loam, which is interspersed with layers of fine gravel that increase in frequency and grain size with depth. The majority of the low-lying portions of the Big Lagoon site is classified by the U.S. Geological Survey (USGS) Soil Survey as Blucher-Cole complex, 2 percent to 5 percent slopes, with the area surrounding the parking lot classified as a saline hydraquent. Upslope areas are classified as Cronkhite-Barnabe complex.

Muir Beach is a Holocene beach comprised of sand deposits at the mouth of Redwood Creek. Just offshore, the San Andreas Fault forms the strike-slip boundary between the Pacific and North America tectonic plates, running along a roughly North-by-Northwest trend. Earthquakes and tectonism are important episodic events that can strongly influence the Big Lagoon system's geomorphic processes. Subsidence following an earthquake is often the trigger which deepens coastal lagoons, and provides additional space to accommodate incoming sediment.

Since the early 1800s, four large earthquakes have been recorded along San Andreas Fault zone, including the "Great San Francisco Quake" of 1906 and the Loma Prieta earthquake of 1989. A sizable earthquake along this fault zone could damage structures in the project area through ground shaking, as well as secondary seismic hazards such as liquefaction and related ground failure. Soils and sediments most susceptible to liquefaction and related types of ground failure are well-sorted, sandy, unconsolidated materials within 50 feet of the surface and saturated by groundwater. For areas containing soils and sediments with high liquefaction susceptibility, the main risk during an earthquake is the potential for

large ground deformations that could include vertical settlements of the ground surface and lateral spreading (i.e., horizontal mass movement of the liquefied ground toward an open face in sloping areas). These hazards could cause damage to existing or future on-site structures such as the Pacific Way bridge.

The Association of Bay Area Governments (ABAG) website (http://www.abag.ca.gov) was consulted to review potential groundshaking and liquefaction hazards. Based on ABAG mapping, the project site is rated as having the highest groundshaking hazard, defined as being near a major, active fault and on average subject to stronger earthquake shaking more frequently. This intense shaking could damage even strong, modern buildings and structures. Liquefaction susceptibility is rated as high, and the liquefaction hazard assuming a seismic event similar to the 1906 earthquake is rated as high near the beach and along Hwy 1, and moderate on the remainder of the site.

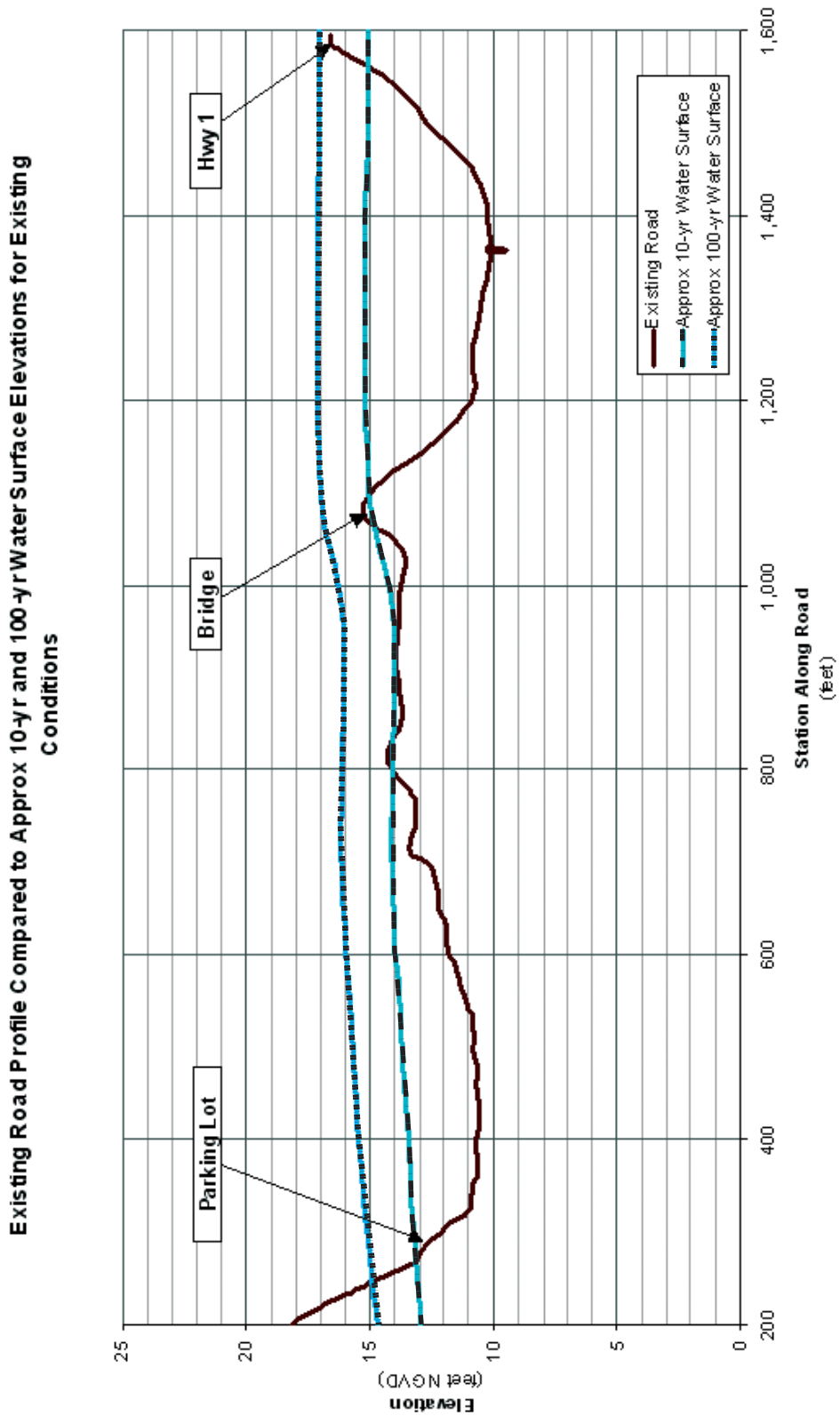
There are no unique geologic or known paleontologic resources in the project area.

Geomorphic Processes

Sediment Sources and Delivery

The morphology and natural maintenance of the Big Lagoon ecosystem has been adversely affected by elevated sediment delivery from the Redwood Creek watershed as a result of the disturbances identified above under Watershed History (Stillwater Sciences 2004). Estimates of the average annual sediment discharge from Redwood Creek watershed for each sediment budget period are summarized in Figure 3.1.1-7. Sediment yields in the periods that post-date Euroamerican land use are up to an order of magnitude higher than the estimated background, natural rate of sediment delivery of the pre-1840 period. In the most recent sediment budget period (1981–2002), total sediment yield dropped by about a factor of two, but is still more than five times greater than estimates for the pre-Euroamerican period. The recent decline in sediment yield, relative to 1841–1980 rates, mainly reflects an inferred reduction in sediment eroded from the floodplain—a change that may be due, at least in part, to the well-documented recent shift from agricultural to parkland uses in the lower watershed. Note that estimates of historic and future sediment yields are subject to uncertainty based on uncertainties in measurement and assumptions. The volumes presented here are from Philip Williams & Associates et al. (2003). Stillwater Sciences (2004) has completed a more comprehensive investigation of sediment yields, but the conclusions of that study do not substantially change the sediment delivery patterns presented on Figure 3.1.1-8. For a complete discussion of the Redwood Creek sediment budget and associated uncertainties, please refer to Stillwater Sciences (2004.)

The majority of sediment deposition in Big Lagoon presumably occurs during and shortly after large floods, rather than on a steady, average-annual basis. Hydrological records and narrative data indicate that notable floods in the watershed occurred approximately once per decade from 1920 to 1970 (i.e., in



Source: PWA 2006

Figure 3.1.1-7
Pacific Way and Flooding

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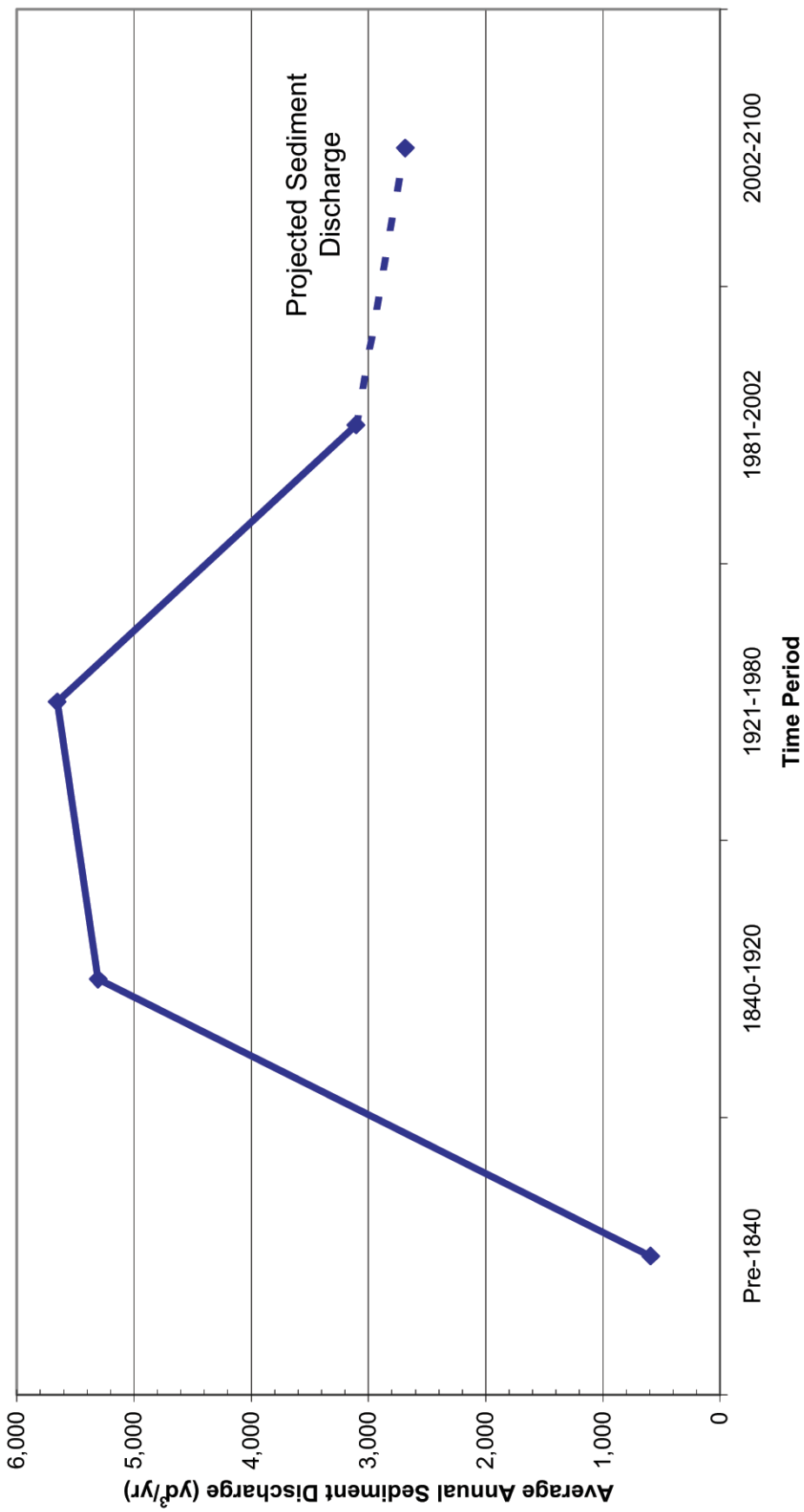

Source: PWA 2006

Figure 3.1.1-8
Estimated Sediment Discharge, Redwood Creek Watershed

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1925, 1935, 1946, 1956, 1967), and twice per decade thereafter (i.e., in 1970, 1973, 1982, 1986, 1995, 1998, 2006).

Future sediment yields to Big Lagoon are speculative; however, contemporary rates of erosion from the watershed are roughly similar to pre-disturbance rates, and based on current land management (i.e., parkland), are expected to remain consistent. The effect of past watershed disturbance and more recent conservation activities appear to have resulted in a fundamental shift in the way sediment is routed through the watershed, and have changed the dominant mode from deposition to entrainment. This has resulted in incision and degradation of floodplain deposits replacing the aggradation that seems to have dominated before about 1840.

Sediment transported into the Big Lagoon site by Redwood Creek originates from a variety of sources, including:

- **Hillslope and Streamside Landslides.** Hillslope erosion and sediment transport in the Redwood Creek watershed occurs by landsliding, gullying, and soil creep (e.g., Lehre 1982). Roughly 46 percent of the watershed's hillslope surfaces have been mapped as landslide deposits (Wentworth et al. 1997). Landslides on watershed slopes sometimes do not affect sediment delivery to the Redwood Creek mainstem due to a lack of connectivity between the landslide scar and the channel network (Stillwater Sciences 2004).
- **Erosion along Tributaries.** This type of sediment input occurs via erosion along the edges of tributaries results from soil creep and landsliding close to the channel, channel enlargement due to changes in upstream runoff, and incision driven by base level changes in Redwood Creek downstream.
- **Road-Related Erosion and Sediment Transport.** Roads, trails and road-crossing failures contribute a significant amount of sediment to Redwood Creek.
- **Sediment Delivery from Green Gulch Creek.** Sediment trapping in Green Gulch reservoirs since the 1950s has made sediment yields to Big Lagoon from Green Gulch slopes negligible during the most recent sediment budget period.
- **Post-1840 Incision of the Redwood Creek Mainstem.** Roughly coincident with Euroamerican arrival in the watershed, Redwood Creek appears to have begun incising into its Holocene alluvial fill—thus enhancing sediment delivery to Big Lagoon.
- **Incision of Tributaries.** Incision of the Redwood Creek mainstem has caused base-level lowering for the watershed as a whole, and thus has led to incision (or gullying) of tributaries into their Holocene fills.

Channel Characteristics and Modifications at Big Lagoon

Channel slope in Frank Valley drops from 0.9 percent at its upstream end to 0.4 percent at the Hwy 1 bridge. Downstream of the Hwy 1 bridge, channel slope decreases to 0.1 percent. Because of elevated sediment supply and delivery,

which exceeds sediment transport ability based on channel gradient, the Big Lagoon area is depositional.

In addition, the channel and floodplain in the reach below the Hwy 1 bridge have been modified substantially over the last several decades. Major modifications in the reach have included:

- construction of floodwalls and placement of bank revetment between the Hwy 1 and Pacific Way bridges;
- construction of a levee across Big Lagoon, conversion of a portion of lagoon habitat to pasture, and isolation most of the floodplain from the creek;
- realignment of Redwood Creek and Green Gulch Creek;
- construction of a dirt/gravel fill parking lot in the lagoon;
- construction of the Pacific Way bridge and concrete box culvert across Redwood Creek at the upstream end of Big Lagoon; and
- periodic dredging of the creek channel to maintain conveyance capacity.

These modifications have reduced floodplain area and have altered channel hydraulics and sediment transport capacity. These changes, combined with the naturally low channel gradient and delivery of sediment derived from large storms, have been causing substantial aggradation in the reach. Channel surveys indicate approximately five feet of channel aggradation occurred between 1993 and 2002 (Klein et al. 2002), resulting in increased flooding, an unstable channel alignment and a heightened risk of avulsion to adjacent pasture (which is several feet lower than the creek bed). High flows escape the channel in at least two locations between the Hwy 1 and Pacific Way bridges, following the valley contours and forming a nascent channel along the low point of the valley.

Measures taken by Marin County and NPS in 2002, 2004 and 2005 to reduce flooding and the risk of channel avulsion have been previously described above. In the period since these actions were completed, scour of the Redwood Creek channel in the willow grove downstream of the pedestrian bridge has been observed, while the area in the vicinity of the Pacific Way bridge and upstream has been subject to continued aggradation.

Reach-Specific Geomorphic Conditions

A more specific description of the morphology and geomorphic processes occurring within specific reaches of the Big Lagoon site are as follows.

Upstream of Pacific Way

The area upstream of Pacific Way Bridge is a depositional area, which is likely related to decreases in flow depths when flows overtop the banks towards the new channel that is forming along the low point of the valley. Flow obstructions caused by the bridge also contribute to sediment deposition. The Marin County Department of Public Works estimates that the capacity of the bridge prior to NPS excavation in 2002 was approximately 600 cfs, insufficient to convey a 2-year flow event of 805 cfs (Klein et al. 2002). Klein et al. (2002) also suggest

that because the bridge is not oriented parallel to the channel flow, flow velocities are reduced and thus contribute to aggradation. By April 2003, just six months after the dredging actions taken by the County and NPS, over 200 cubic yards of sediment had been trapped in this reach, re-filling about half of the excavated area upstream of Pacific Way Bridge.

Pacific Way to Parking Lot

From 1992 to 2002, 2 to 5 feet of sediment accumulated in the channel between the parking lot and Pacific Way Bridge due to the combined effects of flow constrictions by the levee road and the lower end of the parking lot/picnic area and high channel roughness caused by trees that fell in the channel over this period. The lower end of the parking lot, picnic area, and levee road have reduced the natural floodplain corridor by 80 percent, constricting flows upstream, reducing upstream flow velocities, and contributing to sediment deposition. Initial hydraulic modeling results suggest that the current parking lot configuration effects flows over 750 and 800 feet upstream during the 5-year and 50-year flow events, respectively. During the 5-year flow, for example, the lower end of the parking lot and picnic area fill pad raises water surface elevations in the channel by about 1 foot. Since the 2002 actions, however, sediment conveyance in the channel has increased, and the channel has scoured, a reversal of the prior trend of aggradation.

Willow/Alder Grove

The third area of significant channel deposition is in the Willow/Alder Grove downstream of the footbridge. From 1992 to 2002, maximum elevations in the Willow/Alder Grove increased by 1 to 2 feet. This deposition was probably caused by increased roughness in the channel and reduced flow velocities due to the maturing and spreading of willows and alders. The pilot channel excavated in 2003 has re-invigorated flows and has begun to slowly erode the channel bed.

Ocean and Beach Characteristics

Sea Level Rise

The sea level has risen approximately 400 feet since the peak of the last ice age about 18,000 years ago. The bulk of that occurred before 6,000 years ago (Axelrod 1981). From 3,000 years ago to the start of the 19th century the rate of sea level rise was almost constant; however, rates of sea level rise increased in the 20th century. In the last century, the measured rate of rise near San Francisco is 0.7 feet/century or 0.35 feet/50 years (see Table 3.1.1-4).

It is generally agreed upon in the scientific community that anthropogenically induced global warming will cause the rate of sea level rise to increase from current conditions. A variety of estimates have been presented, and estimates issued by the Intergovernmental Panel on Climate Change (IPCC) anticipate sea level rise of between 0.3 and 2.9 feet between years 1990 and 2100 (Intergovernmental Panel on Climate Change 2001). This range is based on the results of the various models used by the IPCC and includes a substantial amount of uncertainty. The IPCC model range of estimates for global sea level average

rise by 2060 is predicted to be 0.2 to 1.3 feet. Using the mid-level of the range of the IPCC models, a predicted global average rise of 0.65 feet would be expected by 2060. However, the models used by the IPCC do not predict uniform global sea level rise and there are substantial regional variations. The IPCC model predictions for the eastern Pacific indicate a range of sea level rise predictions of 0.3 to 1.6 feet by 2100, which is on the lower end of the global range noted above. Most of the sea level rise predictions on the top end of the global range are for the top and bottom of the world, not the middling latitudes in-between. Assuming linear rise by 2060 to be half the rise between 1990 and 2100 (the rise over this period is not linear), the geographic prediction for 2060 from the IPCC models for the eastern Pacific would be 0.15 to 0.8 feet.

Other non-IPCC estimates, such as Overpeck et al. (2006), believe that sea level rise could be much more rapid, and sea levels could be 10 feet or more above current levels by year 2100. However, the IPCC assessments are the most widely accepted basis of knowledge and thus are considered the best scientific data available for project planning purposes.

The hydraulic modeling completed in support of this Final EIS/EIR assumed a sea level rise of 0.7 feet over a 50-year period, which is the mid-range of predictions of global sea-level rise by the IPCC models for the year 2060. This level of increase is twice the historic rate for the last century and near the top of the predicted regional range of rise by 2060 by the IPCC models. Thus, it is considered a reasonable basis of planning for this project.

Table 3.1.1-4. Rates of Sea Level Rise in San Francisco Bay Area

Time Period	Rate (feet per 100 years)
3,500 BP to 1840 A.D.	0.3–0.5
1854–1905	0.4
1906–1999	0.7

Source: Philip Williams & Associates et al. 2003.

Oceanography

Waves on the California coast comprise both seas and swells. Seas consist of short period waves created by local winds, while swells are long period waves that originate from offshore storms, typically in the northern Pacific Ocean. The dominant wave direction is from the northwest (290 to 315 degrees); however, there are periods where seas and, less frequently, swells arrive from a southwesterly direction (Philip Williams & Associates et al. 2003). Wave heights are greatest during winter storms between November and March, when significant wave heights average 9-10 feet and maximum wave heights can reach over 25 feet (Philip Williams & Associates et al. 2003).

Wave erosion potential is primarily controlled by wave power, which is proportional to the square of the wave height (Komar 1998). Given the dominant

north-northwesterly wave direction, Muir Beach is generally characterized by significantly lower wave heights than at other locations such as Pt. Reyes, due to wave shadow effects of Pt. Reyes, Pt. Bolinas, and the local northern headland at Muir Beach. Waves from the north-northwest direction must diffract around these headlands to reach the beach, losing considerable energy in the process.

Muir Beach is directly exposed to south-southwesterly swell and seas, but waves from this direction lose energy due to shoaling on the San Francisco Bar. The orientation and morphology of the beach and headlands are also important for sand transport. Along northern California, the net longshore transport (sand movement parallel to the shoreline) is from north to south, due to the north-northwest dominant wave approach. Sediment transport is not well characterized along the Marin County coast, where headlands and irregular rocky nearshore bathymetry create complex sediment transport pathways. The headlands and offshore bedrock topography act as barriers to longshore transport of sand, except during high-energy conditions when sediment can be more easily entrained around these rocky obstacles. Previous studies in nearby Bolinas Bay and in the Santa Cruz littoral cell (Golden Gate to Monterey Bay) have found annual littoral transport volumes on the order of 150,000–250,000 cubic yards oer year (cy/yr) (Best and Griggs 1991; Interstate Electronics Corporation 1968). Annual sand discharge from Redwood Creek is several orders of magnitude less than sand supplies by longshore transport that is part of the larger littoral cell.

Beach and Dunes

Muir Beach is a sandy pocket beach, bounded by rocky headlands at the mouth of Redwood Creek, a very typical morphology for northern California. Muir Beach undergoes significant seasonal changes in shape as wave conditions vary over the year. At the end of the summer or early fall when typically calm seas occur, a well developed beach berm develops, and the beach reaches its peak width. Over the winter, high-energy, steep waves tend to move sand offshore, lowering and flattening the beach profile. As the high-energy conditions subside in late spring and early summer, the beach recovers as sand is moved on-shore, rebuilding the beach berm.

Muir Beach experiences most severe erosion when high-energy wave conditions coincide with elevated sea levels, allowing waves to penetrate a greater distance inshore and dissipate less energy via bottom friction. El Niño winter storms therefore have greater potential for beach and cliff erosion; these events typically occur every 3 to 7 years and will likely cause severe but temporary beach erosion at Muir Beach.

Between 1992 and 2003, Muir Beach appears to have shifted landward by approximately 50 feet. Berm heights are similar, but the berm has shifted landward, filling and narrowing the tidal lagoon. The topographic data for this analysis has uncertainty, so this trend should not be treated as absolute. However, this landward shift is consistent with the conceptual model of the site (Figure 3.1.1-2).

Annual high winter flows scour the backbeach, inhibiting the landward migration of the beach. Since 1992, flows on the beach have been reduced due to flow constrictions and backwater effects caused by the Willow/Alder Grove downstream of the parking lot. The pilot channel, excavated in 2003, has reinvigorated flows, but the channel was excavated more than 100 feet inland of its historical location. Moving the scouring action of the channel further inland has enabled wave overtopping and wind transport to maintain higher beach elevations in the backbeach area.

Muir Beach's morphology also varies in a shore parallel direction, rising from a minimum elevation (approximately +1 to 2 feet NGVD) at the northern end of the beach to the maximum elevation (approximately +17 feet NGVD) at the dune crests at the southern end of the beach. Local winds typically blow from the north-northwest, building up dunes at the southern end of the beach. The low elevation at the northern end of the beach is maintained by flows from Redwood Creek. Historical maps and photos consistently show the mouth of Redwood Creek at the northern end of the beach. The creek flows to the northern end because it is the most sheltered from wave energy (due to refraction around the northern headland) with the least wave power to rebuild the beach and provide resistance to creek flows.

Since a 1992 topographic survey, the beach elevations in the southern dune area have increased by about 3 feet as a result of a dune restoration program initiated in 1995, which fenced off the field and limited slope disturbances from foot traffic.

Backbeach Lagoon

Lagoon outlets are maintained and scoured by a combination of tidal and freshwater flows. In larger systems, the tidal component (quantified by the tidal prism) tends to control lagoon opening and closure frequency. Conversely, the freshwater inflow component is dominant in small lagoon systems. Wave dynamics and sediment transport also play an important role by determining the shape and elevation of the beach berm.

Lagoon closure is driven primarily by low flows from Redwood Creek in summer. These flows are lost to seepage and evaporation, which in combination with wave action pushing sand landward, causes the lagoon to close. In late fall, once flows in Redwood Creek become high enough to fill the lagoon and overtop the beach berm, flows once again reach the ocean and open the lagoon, quickly scouring a channel through the sand. The exact dates associated with lagoon opening and closure vary based on seasonality of flows in Redwood Creek. The backbeach lagoon at Muir Beach exhibits four seasonal modes of behavior, defined as follows:

1. **Fully Closed:** The lagoon outlet is entirely filled with sand, and the beach berm is at +6 feet NGVD or higher. The lagoon may fill initially with freshwater, but eventually diminishes due to evaporation and seepage. This mode occurs following closure in the mid-summer, and persists until the first major winter storms.

2. **Open, Nontidal:** Periods of strong onshore sand transport build the beach berm up to a level that prevents tidal inflow. At the same time, freshwater inflows are sufficient to maintain an open channel across the berm. During the field monitoring of 1992–1993, this occurred in March of 1993.
3. **Open, Tidal on Spring Tides:** The beach berm is built up to a level that allows tidal inflows only during spring higher high tides; neap tides do not enter the lagoon. Freshwater inflows are still sufficient to maintain an open outlet. This occurs in the spring and early summer prior to full closure.
4. **Open, Partially Tidal:** The outlet channel is scoured to as low as +1 feet NGVD, allowing tidal inflow during all tidal cycles. Low tides are still muted. This mode occurs during the winter when flood flows are very high and the beach profile is eroded by winter storm waves.

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3.1.2 Water Quality

3.1.2.1 Introduction

In anticipation of the restoration of Big Lagoon there has been extensive examination of water quality in the study area. These background documents provide an extensive base of knowledge pertaining to water quality at the project site and in the upstream reaches of Redwood Creek and its tributaries. These documents are listed below. Main sources of information describing baseline conditions include:

- The 1994 EA (Philip Williams & Associates et al. 1994)
- The Site Analysis Report (Philip Williams & Associates et al. 2003)
- The Feasibility Analysis Report (Philip Williams & Associates et al. 2004)
- The Draft 2005 Redwood Creek Watershed Assessment (Stillwater Sciences 2005a)
- Water Quality Analysis of Redwood Creek Watershed data for 2004–2005 (Stillwater Sciences 2005b)

Unless cited otherwise, all of the information below has been distilled from the above reports, and the reader is referred to these documents for a more comprehensive description of water quality.

3.1.2.2 Existing Conditions

The following is a description of the existing water quality in the Redwood Creek watershed. This discussion summarizes results from sampling efforts conducted by the USGS, Harding-Lawson and Associates (HLA), Philip Williams & Associates, Stillwater Sciences and NPS. The focus of this water quality discussion is on temperature, salinity, dissolved oxygen, nutrients, bacteria, and sediment.

Temperature

Temperature affects aquatic organisms and their biological processes. Extreme water temperatures can have deleterious effects on organism life history and reproduction, especially for sensitive species such as salmonids. The San Francisco RWQCB considers an increase of more than 5°F (2.8°C) above natural receiving water temperature to be an adverse affect on water quality (San Francisco Regional Water Quality Control Board 1995). As described in Section 3.2.3, *Fisheries*, temperatures between 10° and 13.9°C are appropriate for salmonids, with temperatures from 13.9° to 15.5°C classified as “at risk,” and temperatures exceeding 18.3°C for any length of time being generally lethal to

juvenile coho salmon. According to Philip Williams & Associates (2003), water temperatures at the project site generally range from 11 to 15°C, with higher temperatures in the summer and early fall months. Sampling conducted by Stillwater Sciences in 2004–2004 confirmed these results, with the highest recorded temperatures in Redwood Creek being in the 12 to 13°C range during the early fall when flows were only 0.4 cfs. Temperature ranges are considered adequate to fulfill beneficial uses and support aquatic life.

Salinity

Salinity is typically measured by the amount of anions, or salts dissolved in water. This is measured by determining total dissolved solids (TDS) and electrical conductivity (EC). As regulated by the RWQCB, an increase in TDS or salinity that adversely affects fish migration or estuarine habitat constitutes a negative impact on water quality (San Francisco Regional Water Quality Control Board 1995). Elevated salinity in the lower part of the project area that is subject to tidal influence is expected and is a natural characteristic of an estuarine system. In general, elevated salinity levels as a result of tidal influence extend to the pedestrian bridge near the beach. Periodic influxes from salt water in the lower, tidal portions of the project site during storm surges can increase salinity in waters upstream of the existing footbridge. Salinity levels at the project site are also influenced by the characteristics of freshwater discharges from Redwood Creek. Water quality monitoring indicates that TDS in freshwater inflows is generally low (in the 100–200 milligrams per liter [mg/l] range).

Dissolved Oxygen

Dissolved oxygen (DO) is an important water quality parameter for aquatic invertebrates and fish, which depend on such oxygen to survive. DO levels depend on various factors, such as temperature, aeration factors (inflow, wind, waves), salinity, and the extent of aquatic plant life respiring in the water. Minimum concentrations of 5 mg/l of dissolved oxygen is considered protective for warm water habitat, while 7 mg/l of dissolved oxygen is considered protective for cold water habitat (San Francisco Regional Water Quality Control Board 1995). Dissolved oxygen sampling efforts conducted in the lower Redwood Creek watershed indicates that dissolved oxygen can fall below 7 mg/l during summer and fall but are generally above the 5 mg/L threshold for warm water. During sampling conducted during 2004–2005 by Stillwater Sciences, the lowest recorded dissolved oxygen levels (approximately 5 mg/l) occurred during early fall during low-flow conditions of 0.4 cfs. Low DO levels during low flow conditions are expected due to the relatively higher temperatures and absence of mixing from inflows, and are not considered problematic but rather a natural characteristic of the system.

Hypersaturated conditions (saturation of DO that is well above 100%) can be indicative of excessive plant growth and eutrophic conditions; such conditions have not been observed at the site. Large diurnal fluctuations in DO can also be

an indicator of eutrophication, as DO levels drop to toxic levels at night as aquatic plants respire; continuous measurements have not been taken to evaluate such fluctuations. As discussed below, it is possible based on nutrient inputs that excessive biological activity could lead to depressed DO levels, and that mildly eutrophic conditions may exist on the site.

Nutrients

Nutrient concentrations change seasonally, as aquatic plants respond to the extent of sunlight and either sequester or release nutrients as they grow or decompose. Agricultural fertilizers, animal waste (e.g., manure), and human waste (e.g., leaky septic systems) can lead to elevated nutrients above background levels, and stimulate plant growth. Rainfall, stream flow, and air and water temperature all influence nutrient concentrations in the watershed. The Basin Plan states that waters shall not contain biostimulatory substances which promote aquatic growths in concentrations that cause nuisance or adversely affects beneficial uses (San Francisco Regional Water Quality Control Board 1995). Nutrient levels are measured by analyzing for ammonia, nitrate, nitrite, and phosphorus concentrations in water. Sampling indicates that nutrient levels are elevated above background concentrations, although still meeting drinking water standards. Sources potentially include leaky septic systems from the Muir Beach community and residences upstream in the watershed, waste from horses stabled at the Golden Gate Dairy, and inputs from Green Gulch Farm. Improved horse management practices at the Golden Gate Dairy are thought to have reduced inputs from that source, although sampling conducted in 2004–2005 indicate that the Golden Gate Dairy Tributary continues to exhibit elevated phosphorus levels. Both nitrogen and phosphorus levels in the project area are of concern in terms of being at levels that can lead to nuisance aquatic growths and eutrophic conditions, although other evidence (e.g., depressed DO levels) does not point to the presence of eutrophic conditions on the site.

Bacteria

To protect recreational uses of water bodies, bacterial water quality objectives are regulated by the RWQCB. Thresholds for coliform bacteria indicate presence of water quality contamination that could result in adverse affects to human health (see San Francisco Regional Water Quality Control Board 1995). For the period of record, bacterial data from a number of sites in the watershed indicate that coliform levels are generally higher at sites downstream of the Golden Gate Dairy and within the project site. Bacterial levels on the Big Lagoon site and at Muir Beach routinely exceed applicable standards, and beach postings to warn the public of a potential health risk are common. Sources of bacteria are believed to be similar to the sources of nutrients identified above (leaky septic systems, and horse and other agricultural inputs from Golden Gate Dairy and Green Gulch Farm). The project site generally does not support beneficial uses related to municipal water supply and water contact recreation.

Sediment

The concentration of suspended sediment in the water column is influenced by stream inflows, bank erosion, and resuspension of sediments by wind or tidal mixing. Water quality contaminants, such as metals or toxic chemicals, sequestered in bottom sediments or adjacent upland areas can adsorb to suspended sediments in the water column. Where contaminants can be adsorbed to suspended sediments, higher concentrations of suspended sediment can lead to higher concentrations of contaminants in the water. Because suspended sediments are highly mobile, they provide a transport mechanism that can cause spreading and deposition of water quality contaminants.

While limited monitoring has been conducted, sediment contaminants are not believed to be present at concentrations that exceed human health or water quality criteria within the project site. As such, the potential for adverse water quality impacts resulting from contaminated sediment at the project site is not considered further.

3.1.3 Water Supply

3.1.3.1 Surface Water Diversions

This section describes the surface diversions and users in the project area. This includes Redwood Creek and its tributaries, including Rattlesnake Creek, West Fork Rattlesnake Creek, Spike Buck Creek, Laguna Creek, Fern Creek, Green Gulch Creek, and unnamed tributaries. Groundwater pumped from surface water underflow (i.e., MBCSD well) is described in the section below on groundwater pumping.

Marin Municipal Water District

MMWD is a public agency that provides drinking water to 190,000 people in a 147-square-mile area of Marin County. The MMWD has pre-1914 appropriative surface water rights for seven locations in the upper Redwood Creek watershed on the following creeks: Fern, Laguna, Spike Buck, and West Fork Rattlesnake. Surface water diversions on Fern and Laguna Creeks are used to supply the West Point Inn and to fight fires. In recent years, the other diversions have not been actively used (Philip Williams & Associates et al. 2003).

San Francisco Zen Center Green Gulch Farm

The SFZC owns and operates the Green Gulch Farm, an organic farm and garden. The Zen Center has an appropriative water right to divert up to 47 acre-feet from Redwood Creek annually within the project site. This diversion has not been used since 1989. The Zen Center also has a water right to divert up to 17 acre-feet from Green Gulch Creek. The Zen Center operates its farm from a system of reservoirs to store and divert surface flows for irrigation, stock watering, fire protection, domestic use, and recreation.

National Park Service

NPS does not provide running water at Muir Beach, and does not have any surface water diversions at the project site.

3.1.3.2 Groundwater Pumping

The Frank's Valley aquifer underlying the Big Lagoon project site and areas upstream in Frank's Valley is a heterogeneous alluvial basin that is hydrologically interconnected with Redwood Creek.

Muir Beach Community Service District

The MBCSD is a local government agency responsible for providing potable water to the residents of the Muir Beach community. The MBCSD services 147 service potable water connections supplying water to approximately 350 people (Martin 2000). The MBCSD operates a groundwater well 1 mile upstream of the project site. The well is approximately 80 feet from Redwood Creek, at the edge of NPS and State Parks property.

The MBCSD received a permit from the State Water Resources Control Board in 2001 to withdraw up to 50.6 acre-feet from this well annually. According to the conditions of the permit, well pumping is limited during the dry season to a maximum gross water production rate of 45,000 gallons per day (gpd). To meet this requirement, well production typically averages 40,000 gpd (Muir Beach Community Services District 2005).

Aquifer tests conducted in 2000 induced infiltration from Redwood Creek to the alluvial aquifer, with streamflow depletion accounting for 70 to 80 percent of the pumping rate of the well. Groundwater modeling indicates that pumping decreases instantaneous flows in Redwood Creek by as much as 0.09 cfs. This decrease is important during the late dry season when natural flows are typically as low 0.1 to 0.2 cfs. (Philip Williams & Associates et al. 2003.)

On-Site and Nearby Wells

Green Gulch Farm has a well at the edge of Field 4, approximately 150 feet from Green Gulch Creek and off of the project site, that is used as a backup well for the farm.

3.1.4 Air Quality

This section discusses federal and state ambient air quality standards and existing air quality conditions in the project area, identifies sensitive receptors in the project area, and describes the overall regulatory framework for air quality management in California and the region. Information presented in this section is based in part on communication with the Bay Area Air Quality Management District (BAAQMD).

The project site is located within Marin County, which is located in the San Francisco Bay Area Air Basin (SFBAAB). The SFBAAB consists of Marin County and six other counties—Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, and Santa Clara, as well as portions of Solano and Sonoma Counties.

3.1.4.1 Regional Climate and Meteorological Conditions

Marin County is bounded on the west by the Pacific Ocean, on the east by the San Pablo Bay, on the south by the Golden Gate, and on the north by the Petaluma Gap. The County is mostly hilly, with most of the population located in small, sheltered valleys on the eastern side of the hills. Western Marin County is usually subject to cool marine air. During summer months, incoming marine air is cooled as it passes over the offshore upwelling region, forming a fog layer along the coast. During winter months, the coastal regions stay relatively warm due to their proximity to the ocean. At these coastal areas, temperatures do not vary much over the year—high 50s in the winter and low 60s in the summer. During the warmest months, September and October, temperatures are typically in the mid to high 60s.

Along the west coast of Marin, wind speeds average 8 to 10 miles per hour (mph). Although most of the terrain throughout central Marin County is not high enough to act as a barrier to the marine airflow, friction caused by the complex terrain is sufficient to slow the airflow. The prevailing wind direction throughout Marin County is generally from the northwest.

Air pollution potential is highest on the eastern side of Marin County, where the semisheltered valleys and largest population centers are located. Currently, most of the development has been along the bay, particularly in southern Marin. In the project area, the influence of the marine air keeps the pollution levels low (Bay Area Air Quality Management District 1999)

3.1.4.2 Criteria Pollutants

The federal and state governments have established ambient air quality standards for six criteria pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter, and lead. Ozone, NO_2, and particulate matter are generally considered to be "regional" pollutants, as these pollutants or their precursors affect air quality on a regional scale. Pollutants such as CO, SO_2, lead, and particulate matter are considered to be local pollutants that tend to accumulate in the air locally. Particulate matter is considered to be a localized pollutant as well as a regional pollutant. In the area where the proposed project is located, ozone and particulate matter are of particular concern. CO and toxic air contaminants (TACs) are also discussed below, although no state or federal ambient air quality standards exist for TACs.

Ozone

Ozone is a respiratory irritant that increases susceptibility to respiratory infections. It is also an oxidant that can cause substantial damage to vegetation and other materials. Ozone is a severe eye, nose, and throat irritant. Ozone also attacks synthetic rubber, textiles, plants, and other materials. Ozone cause causes extensive damage to plants by leaf discoloration and cell damage.

Ozone is not emitted directly into the air, but is formed by a photochemical reaction in the atmosphere. Ozone precursors—reactive organic gases (ROG) and oxides of nitrogen (NO_X)—react in the atmosphere in the presence of sunlight to form ozone. Because photochemical reaction rates depend on the intensity of ultraviolet light and air temperature, ozone is primarily a summer air pollution problem. The ozone precursors, ROG and NO_X, are mainly emitted by mobile sources and by stationary combustion equipment.

State and federal standards for ozone have been set for an 8-hour averaging time. The state 8-hour standard is 0.07 parts per million (ppm), not to be exceeded, while the federal 8-hour standard is 0.08 ppm, not to be exceeded more than three times in any 3-year period. The state has established a 1-hour ozone standard of 0.09 ppm, not to be exceeded, while the federal 1-hour ozone standard of 0.12 ppm has recently been replaced by the 8-hour standard. State and federal standards for ozone are summarized in Table 3.1.4-1.

Carbon Monoxide

CO is essentially inert to plants and materials but can have significant effects on human health. CO is a public health concern because it combines readily with hemoglobin and reduces the amount of oxygen transported in the bloodstream. CO can cause health problems such as fatigue, headache, confusion, dizziness, and even death.

Motor vehicles are the dominant source of CO emissions in most areas. High CO levels develop primarily during winter when periods of light winds combine with the formation of ground-level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle

Table 3.1.4-1. Ambient Air Quality Standards Applicable in California

Pollutant	Symbol	Average Time	Standard (ppm)		Standard (μg/m^3)		Violation Criteria	
			California	National	California	National	California	National
Ozone*	O_3	1 hour	0.09	NA	180	NA	If exceeded	NA
		8 hours	0.070	0.08	137	157	If exceeded	If fourth highest 8-hour concentration in a year, averaged over 3 years, is exceeded at each monitor within an area
Carbon monoxide	CO	8 hours	9.0	9	10,000	10,000	If exceeded	If exceeded on more than 1 day per year
		1 hour	20	35	23,000	40,000	If exceeded	If exceeded on more than 1 day per year
(Lake Tahoe only)		8 hours	6	NA	7,000	NA	If equaled or exceeded	NA
Nitrogen dioxide	NO_2	Annual average	NA	0.053	NA	100	NA	If exceeded on more than 1 day per year
		1 hour	0.25	NA	470	NA	If exceeded	NA
Sulfur dioxide	SO_2	Annual average	NA	0.03	NA	80	NA	If exceeded
		24 hours	0.04	0.14	105	365	If exceeded	If exceeded on more than 1 day per year
		1 hour	0.25	NA	655	NA	If exceeded	NA
Hydrogen sulfide	H_2S	1 hour	0.03	NA	42	NA	If equaled or exceeded	NA
Vinyl chloride	C_2H_3Cl	24 hours	0.01	NA	26	NA	If equaled or exceeded	NA
Inhalable particulate matter	PM10	Annual geometric mean	NA	NA	20	NA	If exceeded	NA
		Annual arithmetic mean	NA	NA	NA	50	NA	If exceeded at each monitor within an area
		24 hours	NA	NA	50	150	If exceeded	If exceeded on more than 1 day per year
	PM2.5	Annual geometric mean	NA	NA	NA	NA	If exceeded	NA
		Annual arithmetic mean	NA	NA	12	15	NA	If 3-year average from single or multiple community-oriented monitors is exceeded
		24 hours	NA	NA	NA	65	NA	If 3-year average of 98th percentile at each population-oriented monitor within an area is exceeded
Sulfate particles	SO_4	24 hours	NA	NA	25	NA	If equaled or exceeded	NA
Lead particles	Pb	Calendar quarter	NA	NA	NA	1.5	NA	If exceeded no more than 1 day per year
		30-day average	NA	NA	1.5	NA	If equaled or exceeded	NA

Notes: All standards are based on measurements at 25ºC and 1 atmosphere pressure. National standards shown are the primary (health effects) standards. NA = not applicable.

* The U.S. Environmental Protection Agency recently replaced the 1-hour ozone standard with an 8-hour standard of 0.08 part per million. EPA issued a final rule that revoked the 1-hour standard on June 15, 2005. However, the California 1-hour ozone standard will remain in effect.

Source: California Air Resources Board 2003.

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emissions. Motor vehicles also exhibit increased CO emission rates at low air temperatures.

State and federal CO standards have been set for both 1-hour and 8-hour averaging times. The state 1-hour standard is 20 ppm by volume, and the federal 1-hour standard is 35 ppm. Both state and federal standards are 9 ppm for the 8-hour averaging period. State and federal standards for CO are summarized in Table 3.1.4-1.

Particulate Matter

Particulates can damage human health and retard plant growth. Health concerns associated with suspended particulate matter focus on those particles small enough to reach the lungs when inhaled. Particulates also reduce visibility and corrode materials. Particulate emissions are generated by a wide variety of sources, including agricultural activities, industrial emissions, dust suspended by vehicle traffic and construction equipment, and secondary aerosols formed by reactions in the atmosphere.

The federal and state ambient air quality standard for particulate matter applies to two classes of particulates: particulate matter 10 microns in diameter or less (PM10) and particulate matter 2.5 microns in diameter or less (PM2.5). The state PM10 standards are 50 micrograms per cubic meter ($\mu g/m^3$) as a 24-hour average and 20 $\mu g/m^3$ as an annual geometric mean. The federal PM10 standards are 150 $\mu g/m^3$ as a 24-hour average and 50 $\mu g/m^3$ as an annual arithmetic mean. The federal PM2.5 standards are 15 $\mu g/m^3$ for the annual average and 65 $\mu g/m^3$ for the 24-hour average. The State PM2.5 standard is 12 $\mu g/m^3$ as an annual geometric mean. State and federal standards for particulate matter are summarized in Table 3.1.4-1.

Toxic Air Contaminants

Although ambient air quality standards exist for criteria pollutants, no standards exist for TACs. Many pollutants are identified as TACs because of their potential to increase the risk of developing cancer or because of their acute or chronic health risks. For TACs that are known or suspected carcinogens, the California Air Resources Board (ARB) has consistently found that there are no levels or thresholds below which exposure is risk-free. Individual TACs vary greatly in the risk they present. At a given level of exposure, one TAC may pose a hazard that is many times greater than another. For certain TACs, a unit risk factor can be developed to evaluate cancer risk. For acute and chronic health risks, a similar factor called a Hazard Index is used to evaluate risk. In the early 1980s, the ARB established a statewide comprehensive air toxics program to reduce exposure to air toxics. The Toxic Air Contaminant Identification and Control Act (Assembly Bill [AB] 1807; Tanner 1983) created California's program to reduce exposure to air toxics. The Air Toxics "Hot Spots" Information and Assessment Act (AB 2588; Connelly 1987) supplements the AB 1807 program by requiring a statewide air toxics inventory, notification of people exposed to a significant health risk, and facility plans to reduce these risks. ARB has identified diesel exhaust particulate matter as a TAC.

3.1.4.3 Existing Air Quality Conditions

Existing air quality conditions in the project area can be characterized in terms of the ambient air quality standards that the federal and state governments have established for various pollutants (Table 3.1.4-1) and by monitoring data collected in the region. Monitoring data concentrations are typically expressed in terms of ppm or μ/m^3. The nearest air quality monitoring station in the vicinity of the proposed project area is located in San Rafael. The San Rafael monitoring station monitors ozone, CO, and PM10, but does not monitor PM2.5. Air quality monitoring data from the San Rafael monitoring station is summarized in Table 3.1.4-2. This data represents air quality monitoring data for the last three years (2003–2005) in which complete data is available. As indicated in Table 3.1.4-2, the San Rafael monitoring station experienced 6.1 violations of the state 24-hour PM10 standard during the last 3 years for which complete data are available. No other violations were observed for any other pollutants monitored

If monitored pollutant concentrations meet state or federal standards over a designated period of time, the area is classified as being in attainment for that pollutant. If monitored pollutant concentrations violate the standards, the area is considered a nonattainment area for that pollutant. If data are insufficient to determine whether a pollutant is violating the standard, the area is designated unclassified.

The EPA has classified Marin County as a marginal nonattainment area for the 8-hour ozone standard. For the CO standard, areas within urbanized areas (described in the Technical Support document from March 29, 1985, 50 CFR 12540) are classified as a moderate (≤12.7 ppm) maintenance area, while the rest of the County is classified as an unclassified/attainment area. The EPA has classified the County as an unclassified/attainment area for the PM10 and PM2.5 standards.

The ARB has classified the County as a serious nonattainment area for the 1-hour ozone standard. For the CO standard, the ARB has classified the County as an attainment area. The ARB has classified the County as a nonattainment area for the PM10 and PM2.5 standards. The County's attainment status for each of these pollutants relative to the NAAQS and CAAQS is summarized in Table 3.1.4-3.

Table 3.1.4-2. Ambient Air Quality Monitoring Data Measured at the San Rafael Monitoring Station

Pollutant Standards	2003	2004	2005
Ozone			
Maximum 1-hour concentration (ppm)	0.087	0.091	0.081
Maximum 8-hour concentration (ppm)	0.067	0.063	0.059
Number of days standard exceeded[a]			
NAAQS 1-hour (>0.12 ppm)	0	0	0
CAAQS 1-hour (>0.09 ppm)	0	0	0
NAAQS 8-hour (>0.08 ppm)	0	0	0

Carbon Monoxide (CO)			
Maximum 8-hour concentration (ppm)	2.03	1.96	1.66
Maximum 1-hour concentration (ppm)	3.8	3.2	3.0
Number of days standard exceeded[a]			
NAAQS 8-hour (≥9.0 ppm)	0	0	0
CAAQS 8-hour (≥9.0 ppm)	0	0	0
NAAQS 1-hour (≥35 ppm)	0	0	0
CAAQS 1-hour (≥20 ppm)	0	0	0
Particulate Matter (PM10)[b]			
National[c] maximum 24-hour concentration ($\mu g/m^3$)	39.1	51.0	37.1
National[c] second-highest 24-hour concentration ($\mu g/m^3$)	32.8	36.0	31.0
State[d] maximum 24-hour concentration ($\mu g/m^3$)	40.5	52.3	39.1
State[d] second-highest 24-hour concentration ($\mu g/m^3$)	33.4	37.9	32.6
National annual average concentration ($\mu g/m^3$)	17.0	17.4	16.0
State annual average concentration ($\mu g/m^3$)[e]	17.6	17.9	16.5
Number of days standard exceeded[a]			
NAAQS 24-hour (>150 $\mu g/m^3$)[f]	0.0	0.0	0.0
CAAQS 24-hour (>50 $\mu g/m^3$)[f]	0.0	6.1	0.0

Sources: California Air Resources Board 2006; U.S. Environmental Protection Agency 2006.

Notes: CAAQS = California ambient air quality standards.
NAAQS = national ambient air quality standards.
– = insufficient data available to determine the value.

[a] An exceedance is not necessarily a violation.

[b] Measurements usually are collected every 6 days.

[c] National statistics are based on standard conditions data. In addition, national statistics are based on samplers using federal reference or equivalent methods.

[d] State statistics are based on local conditions data, except in the South Coast Air Basin, for which statistics are based on standard conditions data. In addition, State statistics are based on California approved samplers.

[e] State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.

[f] Mathematical estimate of how many days concentrations would have been measured as higher than the level of the standard had each day been monitored.

Table 3.1.4-3. 2005 Marin County Attainment Status for State and Federal Standards

Pollutant	Federal	State
1-hour O_3	NA[1]	Serious non-attainment
8-hour O_3	Marginal nonattainment	NA[2]
CO	Moderate (≤ 12.7 ppm) maintenance area for the Urbanized Areas (3/29/85, 50 CFR 12540), unclassified/attainment area for rest of the County	Attainment
PM10	Unclassified/attainment	Non-attainment
PM2.5	Unclassified/attainment	Non-attainment

Notes:

[1] Previously in non-attainment area; no longer subject to the 1-hour standard as of June 15, 2005.

[2] ARB approved the 8-hour ozone standard on April 28, 2005. It is expected to become effective in early 2006.

3.1.4.4 Sensitive Land Uses

The BAAQMD generally defines a sensitive receptor as a facility or land use that house or attract members of the population that are particularly sensitive to the effects of air pollutants, such as children, the elderly and people with illnesses. Examples of sensitive receptors include schools, hospitals, convalescent facilities, and residential areas. Sensitive receptors located in the vicinity of the project area include: residences located west of the project area; the Pelican Inn, located at the corner of Pacific Way and Hwy 1; Golden Gate Dairy, across Hwy 1 from the Pelican Inn; Green Gulch Farm, located east of the project site; and recreational users of Muir Beach. Figure 1-3 shows the project site and adjacent sensitive receptors.

3.2 Biological Resources

3.2.1 Vegetation Communities and Wetlands

The GGNRA is part of the California Floristic Province, characterized by Mediterranean vegetation, and a zone of overlapping marine provinces (Californian and Oregonian), leading to a wide diversity of terrestrial and aquatic habitats (Bakker 1984). Historic and existing vegetation communities and wetlands, and ecological functions and processes in the project area have been extensively described in a variety of other documents. Documents consulted for the site included a review of historic aerial photographs and site maps from 1853 and 1892 that include notes on vegetation. Main sources of information describing historic and baseline conditions at the site include:

- The 1994 EA (Philip Williams & Associates et al. 1994)
- The 2003 Site Analysis Report (Philip Williams & Associates et al. 2003), including a classification of wetlands at the site according to Cowardin *et al.* (1979)
- The Draft 2005 Redwood Creek Watershed Assessment (Stillwater Sciences 2005a)
- Site reconnaissance.

This affected environment section focuses on the existing rather than historic vegetation communities and wetlands.

Vegetation Communities

Big Lagoon Site

Existing vegetation at the project site is largely composed of riparian forest and scrub (referred to as “riparian wetland”), and seasonally to semi-permanently flooded emergent wetlands (Figure 2-1), containing both native and nonnative plant species. Major plant associations described below include tidal lagoon, open water, riparian wetland, other wetland, dune habitat, upland habitat, and developed areas. Beach and near-shore ocean habitats would not be directly affected by the project, and so are not described in this chapter. Relative acreages of the vegetation communities that have been quantitatively mapped are presented in Table 2-3.

Fill Disposal Sites

The Unused Reservoir Pit is composed of upland habitat, including modified coastal scrub, annual grassland, and ruderal vegetation communities. The upper Banducci field consists of riparian wetland and disturbed/ruderal (agricultural) vegetation communities.

Open Water

Tidal Lagoon

A tidal backbeach lagoon is present immediately upstream of the confluence of Redwood Creek with the Pacific Ocean. This backbeach lagoon is a seasonally variable feature, changing in response to the relative influence of wave action that builds up the beach and stream flows that scour and maintain a channel across the beach. The lagoon is a partially tidal water body in winter when the mouth is open. By mid to late summer, waves have constructed a beach berm above tidal elevations, closing off the lagoon from tidal input. By November or December, the first winter storms arrive, with large swells eroding the beach berm and rainfall-elevating stream flows to the lagoon. Stream flows scour a channel through the beach berm and deepen the lagoon bed during storms, expanding the areal extent and depth of the lagoon. The tidal lagoon is unvegetated.

Freshwater and Brackish Areas

Open water upstream of the tidal lagoon includes permanently flooded or intermittently exposed habitat, including the Redwood Creek channel and the unnamed tributary through the Green Gulch pasture. Redwood Creek is brackish to approximately the existing pedestrian bridge.

Nineteen of the 52 species (37%) recorded in permanently flooded or intermittently exposed habitat within the Big Lagoon project area were nonnative. Nonnative species are concentrated along the lower creek edges; the dominant cover includes ox-tongue, creeping bent grass, and pennyroyal. The nonnative knotgrass covers much of the shallow water flats downstream of the footbridge. Three emergent native plants are most common: three-square rush, cattail, and species of bulrush. Other native wetland species that grow in the area include water plantain, tall cyperus, monkey flower, and small red alders. Other species include water parsley, dotted smartweed, floating marsh pennywort, silverweed, and Baltic rush.

Riparian Wetland

Due to historic disturbances (i.e., agriculture), most of the riparian vegetation in the project area is no more than 40 to 50 years old. Riparian vegetation at the site is composed primarily of a dense canopy of red alder, arroyo willow, and yellow willow, and an understory of thimbleberry, blackberry, and red elderberry mixed

with thick stands of nettles , water parsley, hedgenettle, native morning glories, and nonnative cape ivy and English ivy. Patches of cattail and other emergent vegetation grow at the waters edge. Fifteen of the 49 species (31%) identified in riparian areas are nonnative. Most of the nonnative species occupied the riparian edge; however, a relatively high cover of nonnative English and cape ivy occurred well within the forest.

Other Wetlands

Green Gulch Pasture

As described in Section 3.1.1, *Watershed Processes*, in the 19th century, the Green Gulch pasture area was historically a wetland. From the 1840s onwards, it was filled with as much as 6 feet of sediment through deposition and mechanical fill. The Green Gulch pasture area has since transitioned from a relatively dry, elevated, flat grazing area dominated by grasses, back to a seasonal wetland as surface and groundwater levels have risen over the past 10 years. Management activities conducted by NPS in late 2002 to excavate the channel have probably lowered groundwater elevations, but NPS still manages a weir structure to pond water in the pasture during the spring and early summer for CRLF.

There are currently three distinct water regimes and corresponding vegetation communities in the pasture, moving from west to east, including (1) a semi-permanently flooded region that runs adjacent to the levee road and is dominated by cattails transitioning into (2) a seasonally flooded emergent wetland area; and (3) the seasonally saturated rectangular field between Green Gulch Creek and an unnamed tributary. In addition to cattails, dominant native species include obligate or facultative wetland species such as spikerush, water plantain, silverweed, and water parsley.

Of the 56 plant species recorded, 30 (54%) were nonnative. These nonnative species, including annual grasses, penny royal, creeping bent, clustered dock, bull thistle, poison hemlock, and ox-tongue are concentrated around disturbed areas (e.g., adjacent to the levee road, trail, or horse paddock area) and areas that are more elevated and dry (e.g., the pasture between Green Gulch Creek and the unnamed tributary, which is dominated by annual bluegrass). A few native trees grow along the pasture side of the levee, including black cottonwood (native to coastal California but not historically locally native), California buckeye, shore pine, and an elderberry.

Brackish Marsh

A brackish marsh area is present between the tidal lagoon and the parking lot, divided by a former beach access trail, and bounded by the willow/alder grove and the hillside residential area. A buried retaining wall (built in conjunction with the former tavern) appears to serve as a barrier between the brackish marsh community and the disturbed area dominated by Kikuyu grass located immediately adjacent to the parking lot. Recent wetland mapping shows the area between the tidal lagoon and the parking lot, excluding the willow/alder grove, as a mix of seasonally to semipermanently flooded emergent wetland, with a small

strip of permanent tidal emergent wetland. The species composition is currently dominated by salt rush, salt grass, and silverweed.

Dune Habitat

Dune habitat is located in the southwestern portion of the project site, occupying the narrow fringe between the intertidal zone and the lower creek channel. The lobed dunes at Muir Beach are characterized by very low species diversity. Sixteen species of plants have been observed on dune habitat. The predominant species are the most common of dune plants, such as beach bur, yellow sand verbena, and sea rocket. Dune grasses at the foredunes such as native dune grass and creeping wild-rye (possibly beach wild-rye) also occur. Some areas of the dunes grade into wetter areas and occur with riparian species such as mugwort and California bee plant. Nonnative grasses such as ripgut brome have a greater area of cover in some dunes than native species. (Shoulders pers. comm.)

The lobes that occur at Muir Beach are disconnected from one another by well-used visitor paths across the beach, preventing natural dune formation processes from occurring. Fencing in some areas has allowed for recruitment of dune formations and species.

Upland Habitats

Upland habitat, consisting of modified coastal scrub, while not present on the site itself, grows adjacent to the site on the surrounding hills. While no attempt has been made to generate a comprehensive species list, areas sampled have resulted in 49 recorded plant species. Areas sampled are comprised of a high cover of nonnative annual species, including hair grass, soft chess, cut-leaved geranium, annual fescues, hedgehog dogtail, and plantain. These nonnatives comprise 47%of the species recorded in upland sites. Needle grass, blue wild rye and yarrow are the most common natives recorded. In addition, dense thickets of nonnative Harding grass, thistles, and poison hemlock grow in swales where cattle grazing likely occurred in the past.

Developed Areas

Developed portions of the project area include Pacific Way, the levee and perimeter roads, the parking lot and associated facilities, hiking trails, and other anthropogenically disturbed areas that do not sustain vegetation, or are made up of ruderal vegetation communities.

Wetlands and Other Waters of the United States

USACE-jurisdictional wetlands have been mapped at the site according to the methods described in the Corps of Engineers Wetland Delineation Manual (U.S. Army Corps of Engineers 1987), which showed no substantial differences in wetland acreages compared to the USACE wetland map. The most recent update to the Corps delineation was completed in July 2006, based on a field verification by the USACE. The map, pending certification by USACE, classified 26.5 acres as potential jurisdictional wetlands and 2.6 acres as waters of the United States. This included the riparian wetland immediately upstream of Pacific Way, the entire Green Gulch pasture, and additional areas south and east of the parking lot. Most of the project area lies within jurisdictional wetlands, except the levees, parking lot, and small areas along Hwy 1. Figure 3.2.1-1 shows a map of delineated wetlands. As previously discussed, wetlands at the site have also been mapped using the Cowardin classification system (Cowardin et al. 1979) in 2002 and 2003. Refer to Figure 23 in the Site Analysis Report (Philip Williams & Associates et al. 2003) for a map of Cowardin-delineated wetlands. When overlain, the area delineated by each wetland mapping protocol is almost exactly the same. Because of this, characterization and impact disclosure of wetlands throughout this document would be applicable to both Cowardin and USACE delineated wetlands.

Plant Species

A variety of common plant species occur at the project site, including both native and nonnative species. For a complete compilation, including associated habitats, please refer to Appendix C of the Site Analysis Report (Philip Williams & Associates et al. 2003). Of the 219 species reported, 64 percent (n = 140) were native and 36% (n = 79) were nonnative. Predictably, most nonnative vegetation grows in disturbed areas currently impacted by human activity (e.g., roadsides, trailsides, and picnic areas). In contrast, species diversity and cover of native species are greater in less-impacted riparian, aquatic, and upland sites. In general, nonnative species, including nonnative perennial grasses such as Harding grass and tall fescue, dominate the higher, drier areas of the Green Gulch pasture, and a mix of native species and nonnative weeds (particularly invasive Mediterranean annual grasses) have established on habitat edges such as the levee. Riparian, aquatic, dune, and marsh habitats are typically dominated by native species, with nonnative species varying in their importance between these communities (see “Vegetation Communities” above) (Philip Williams & Associates et al. 2003).

Special-Status Plants

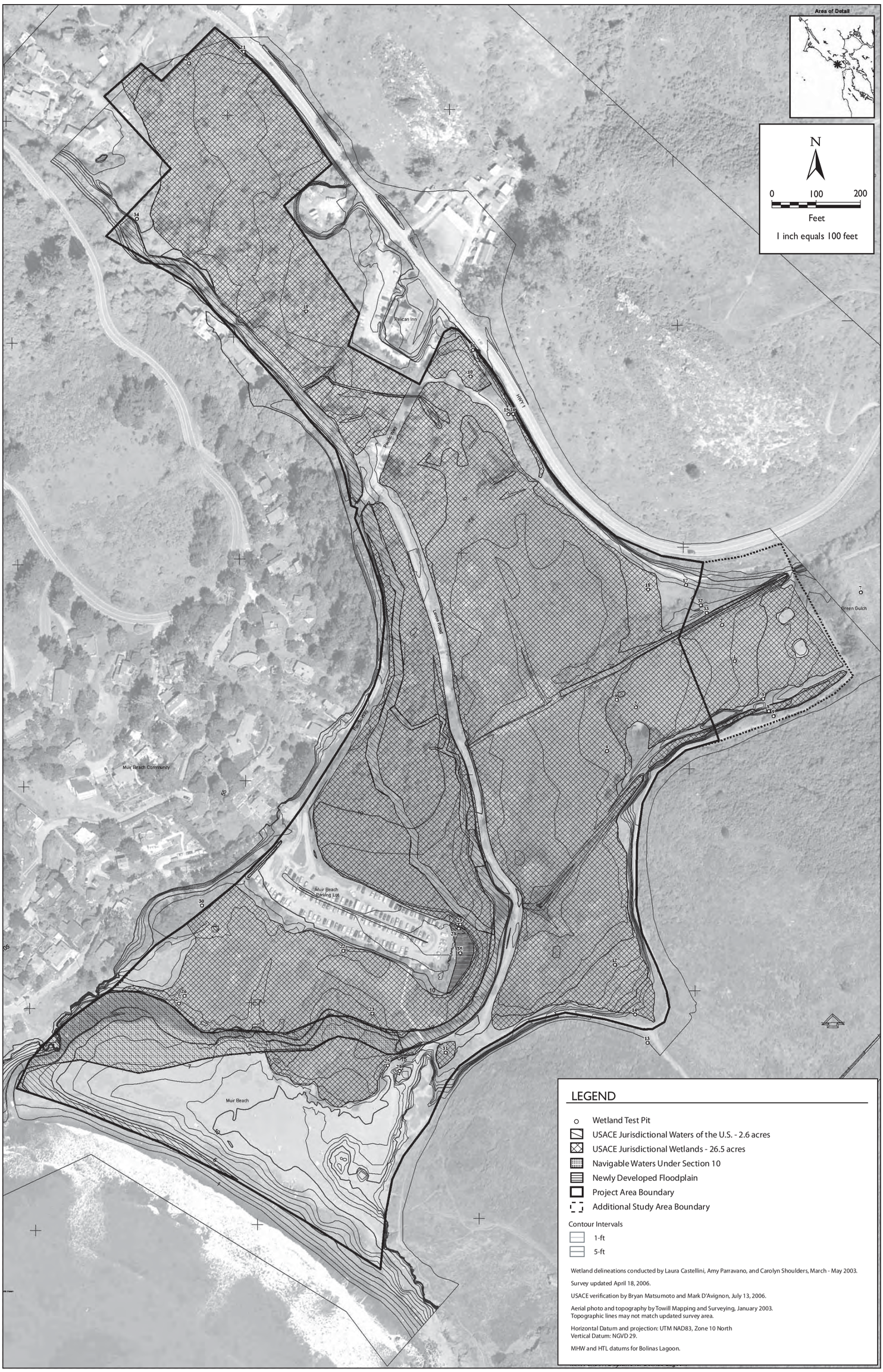
No special-status plant species are known to occur at the project site (Faden 2002, Philip Williams & Associates et al. 2003, Taylor 2003, and field reconnaissance conducted as part of preparation of this EIS/EIR). Special-status species recognized by CNPS that may have historically occurred at the project

site consist of Sonoma alopecurus, California bottlebrush grass, Thurber's reed grass, San Francisco wallflower, Point Reyes bird's-beak), beach layia, Point Reyes lupine, Marin knotweed, nodding semaphore grass, and swamp bellflower (Philip Williams & Associates et al. 2003). Surveys have also included searches for San Francisco spineflower, Lobb's water-crowfoot, and pink sand verbena (Faden 2002).

Two CNPS 4 (watch list) plant species were found in the hills near Muir Beach outside of the project site: California bottlebrush grass (found in riparian habitat), and San Francisco wallflower (found on coastal dunes) (Philip Williams & Associates et al. 2003). California bottlebrush grass has been found as recently as 2003 on nearby Green Gulch trail (Van Noord pers. comm.).

Invasive Nonnative Plants

A variety of nonnative plant species occur at the project site. Key invasive nonnative species of concern at the site include cape ivy, Himalayan blackberry, and nonnative invasive perennial grasses, such as Kikuyu grass, Harding grass, and tall fescue. As described above, most nonnative vegetation grows in disturbed or drier (i.e., upland) areas. Appendix C of the Site Analysis Report (Philip Williams & Associates et al. 2003) contains a comprehensive list of nonnative species and associated habitats.



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Jones & Stokes

Figure 3.2.1-1
Jurisdictional Delineation Map

Exhibit 2: Final Environmental Impact Statement

3.2.2 Wildlife and Wildlife Habitat

In anticipation of the restoration of Big Lagoon there has been extensive examination of the ecological attributes of the study area (Philip Williams & Associates et al. 1993; Golden Gate National Parks Association 2004; Golden Gate National Recreation Area 2005). Each of those documents and several others describe the existing conditions of the study area at length. Following is a summary of these descriptions; for a more detailed description, please refer to the referenced documents themselves.

3.2.2.1 Habitat Types

See Section 3.2.1, *Vegetation Communities and Wetlands*, for a description of habitat types found at the project site.

3.2.2.2 Wildlife Assemblages

The following is a summary of the wildlife assemblages that have been documented at Big Lagoon. The summary is adapted from Philip Williams & Associates et al. (2003), in which a more thorough discussion can be found in that document, along with complete lists of all surveys conducted and species observed. A list of special-status species and habitat occurring at the site is presented in Table 3.2.2-1.

Table 3.2.2-1. Special-Status Wildlife Known to Occur or That May Occur in the Study Area

Species	Status[a] Federal	Status[a] State	Habitat	Observed at Project Site
Invertebrates				
California freshwater shrimp *Syncaris pacifica*	E	E	Pool areas of low-elevation, low-gradient streams, among exposed live tree roots (e.g., willows and alders) of undercut banks, overhanging woody debris, or overhanging vegetation.	No
Myrtle's silverspot butterfly *Speyeria zerene myrtlaeae*	E	–	Coastal dune, coastal terrace prairie, coastal bluff scrub, and associated non-native grassland habitats.	No
Ricksecker's water scavenger beetle *Hydrochara ricksecker*i	SC	–	Seasonally ponded wetlands.	No
Amphibians				
CRLF *Rana aurora draytonii*	T	SSC	Dense, shrubby riparian vegetation associated with deep (0.7 m), still or slow-moving water. The shrubby riparian vegetation that structurally seems to be most suitable is that provided by arroyo willow; cattails and bulrushes also provide suitable habitat.	Yes
Reptiles				
Western pond turtle *Emys [Clemmys] marmorata*	SC	SSC	Ponds, marshes, rivers, steams, and irrigation ditches with aquatic vegetation.	Yes
Birds				
California brown pelican *Pelecanus occidentalis californicus*	E	E, FP	Bays, estuaries, beaches, and ocean habitats.	Yes
American Peregrine Falcon *Falco peregrinus anatum*	–	E, FP	Nesting and wintering habitats are varied, including wetlands, woodlands, other forested habitats, cities, agricultural areas and coastal habitats.	Yes
Willow flycatcher *Empidonax traillii*	–	E	Deciduous thickets, especially willows and often near water	Yes

Species	Status[a] Federal	Status[a] State	Habitat	Observed at Project Site

[a] Status explanation:

Federal:

E = listed as endangered under the federal Endangered Species Act.

T = listed as threatened under the federal Endangered Species Act.

SC = species of concern; species for which existing information indicates it may warrant listing but for which substantial biological information to support a proposed rule is lacking.

– = no listing.

State:

E = listed as endangered under the California Endangered Species Act.

FP = fully protected under the California Fish and Game Code.

SSC = species of special concern in California.

– = no listing.

Invertebrates

Potential habitat exists for the federally endangered California freshwater shrimp in the project area (Fong 1999). However, surveys in March and August 1997 found no shrimp in lower Redwood Creek (Fong 1999), and no sensitive invertebrate taxa were encountered during surveys in April 2002 (Fong et al. 2003).

Monarch butterflies were historically present in great numbers in the vicinity of the project area, but now are only present in small numbers and likely only use the site for foraging rather than overwintering. They utilize eucalyptus, cypress, and Monterey pine trees for clustering sites during winter. At the project site, they primarily use the Monterey pine trees on the hill above (to the north of) Pacific Way.

Other special-status invertebrate species that depend on coastal or marsh communities and may be locally present include the Myrtle's silverspot butterfly, Ricksecker's water scavenger beetle, and the San Francisco fork-tailed damselfly. Myrtle's silverspot butterfly is found in coastal dunes, scrub, and grassland, and is closely associated with larval and food plants e.g., as violet) in areas sheltered from the wind below 820 feet, within 3 miles of the coast. It has not been observed in GGNRA and is not likely to be present in the project area.

Amphibians

Amphibian species observed at the site have been documented primarily at ponded or channelized areas. These standing water locations are essential to the viability of the amphibian assemblage at the site. It is typically these localized

wet spots that support wetland vegetation that provides necessary cover for reproductive activities to occur. The current assemblage of amphibians at the site both in terms of numbers and species reflects the size and health of available wetland habitat (Philip Williams & Associates et al. 2003). At present, much of the wetland habitat on the site is artificially maintained by a flashboard structure along the levee road, which holds ponded water from draining to Redwood Creek.

Several amphibian surveys (Philip Williams & Associates et al. 1994, Ely 1993) have been done within the study area. During these surveys, several of the amphibian species historically thought to persist in the area were present. During subsequent surveys (Cook 1998, Fong 2000, Fellers and Kleeman 2005~~2003~~, Fellers and Guscio 2004~~2003~~) fewer species were detected. Two species not detected include the California giant salamander and the foothill yellow-legged frog. It is thought that the California giant salamander likely persists in the upper watershed of Redwood Creek and occasionally washes down into the study area (Fong pers. comm.). Although no foothill yellow-legged frogs have been recorded in the study area, habitat conditions remain suitable for this species. . No nonnative species (e.g., bullfrogs) were observed during surveys up Redwood Creek and in the ponds at the Green Gulch Farm (Philip Williams & Associates et al. 1994). California newts were the most abundant adult individuals observed. Other adult amphibian species occurred in low numbers year round (Philip Williams & Associates et al. 1994). Adult Pacific tree frogs were seen or heard from December through May. The ensatina and slender salamander were occasionally encountered on the margins of wetland habitat in the winter and spring months.

Herpetological surveys documented that the site currently supports at least one special-status species: the CRLF (federally listed threatened, state listed species of special concern). The study site is not within Critical Habitat as designated by the USFWS (71 FR 19244–19346). The size of the CRLF population at Big Lagoon has been variable, and the species was not observed at the site during 2004 and 2005, leading to the conclusion that it was potentially no longer present at the site. However, a CRLF was sighted at Big Lagoon in early 2006. The frog observed appeared to be a juvenile, suggesting that successful breeding had occurred in the previous year when no frogs were observed during the surveys (Wood 2006).

Reptiles

Five reptile species were observed during 1992 and 1993 herpetological surveys at the site (Philip Williams & Associates et al. 1994; Ely 1993): the western pond turtle, western fence lizard, western terrestrial garter snake, northern alligator lizard, and the western aquatic garter snake.

Western pond turtles (state listed species of special concern) were seen throughout the year during 1992–1993 surveys by Philip Williams & Associates et al. (1994) in two locations along the dredged portion of Redwood Creek, but

were not observed during species-specific surveys conducted in 1996 (Fong 2002b). This species has not been observed at the site for several years and is not considered to currently occur at the project site.

The western fence lizard occurred as an upland resident, and the coast garter snake was observed foraging in upland as well as wetland and riparian habitats. While garter snakes were less common in the afternoon amphibian surveys (Philip Williams & Associates et al. 1994), they were seen in substantial numbers during qualitative reptile surveys.

Three reptile species were incidentally observed in 2002 during surveys for CRLF (Fellers and Guscio 2004): yellow-bellied racer, western fence lizard, and western terrestrial garter snake.

Birds

Listed below are four primary sources of information on birds that exist for the Big Lagoon project area and were reported in Philip Williams & Associates et al. (2003). For a more detailed list of the species that can be found in each of the existing habitat types, refer to Philip Williams & Associates et al. (1994).

1. Philip Williams & Associates et al. (1994) conducted seasonal surveys for 1.25 years, in 1992/1993. A total of 11 surveys at 16 stations were conducted in all seasons. Survey stations were stratified by general habitat type. The objective was to measure seasonal use of a range of habitats that would potentially be affected by restoration activities.
2. Stallcup (1995) produced an annotated bird list for the site by surveying the entire area once per month for one year (May 1994 to April 1995) and summarizing the National Audubon Society's Christmas Bird Census from 1978 to 1992. These data represent an excellent inventory of the avifauna of the site and immediate environs.
3. Point Reyes Bird Observatory (PRBO) and GGNRA have been monitoring breeding bird populations in the project area using nationally standardized protocols from 1997 to the present. This study focuses on passerines and near passerines and is part of a much larger monitoring effort along Point Reyes National Seashore (Gardali and Geupel 1997; Gardali et al. 1999; Holmes et al. 1999; Scoggin et al. 2000; Gardali et al. 2001).
4. Dybala (2002) conducted surveys for waterbirds at the site beginning on December 12, 2001, and continuing approximately every two weeks until February 12, 2002. In total, five surveys were conducted at the site in the Green Gulch pasture and horse paddock. Surveys were conducted at three sites: Pasture A, Pasture B, and the Riding Ring. Visual surveys were conducted from a fixed point at each site. The duration of each survey was at least 15 minutes per site.

Stallcup (1995) reported that 185 bird species were identified in the area. Of these, three are not native to North America, 45 were documented as breeders, 6

others were noted as possible breeders, and 12 were considered accidental. Riparian habitats were identified as “the most thoroughly used” in all seasons, which is in agreement with Philip Williams & Associates et al. (1993). Stallcup (1995) did not quantify species abundance. However, he notes that some of the most common nesting species were Swainson’s thrush, Wilson’s warbler, song sparrow, Brewer’s blackbird, and American goldfinch.

PRBO documented a total of 51 species during point count efforts from 1998 to 2002 along Redwood and Lagunitas Creeks. This did not include species observed flying over the area during surveys. Red-winged blackbird, song sparrow, Swainson’s thrush, cedar waxwing, Wilson’s warbler, American robin, and black-headed grosbeak were the most commonly detected species. All of these species breed at the site with the exception of cedar waxwing (see references listed above).

Most of the bird species that have been observed in the study area are protected under the Migratory Bird Treaty Act. In addition, one species, the California brown pelican, is federally listed as endangered, and three species—California brown pelican, American peregrine falcon, and willow flycatcher—are state listed as endangered. The special-status species mostly likely to be affected (positively or negatively) by changes to the project area are those that use the riparian and freshwater marsh habitats.

Mammals

Columbian black-tailed deer have been seen frequently in the study area, as have other common mammalian species such as coyote, striped skunks, brush rabbit**,** and western gray squirrels. Both bobcats and gray foxes have been seen infrequently along the riparian corridor. Gray foxes likely use the dense willow thicket as a denning area and both species used riparian areas as movement corridors.

Live trapping for small mammals was conducted at the site from October 28 to November 1, 2002, by the USGS (Takekawa et al. 2003). Traps were set in dune, pasture, riparian, tidal lagoon, and wetland areas. The following four species were captured, in order of abundance: western harvest mouse, deer mouse, California vole, and roof rat. Deer mice were captured only in the dune area. No special-status species (e.g., salt marsh harvest mouse, Point Reyes jumping mouse) were detected, despite careful examination of tail characteristics that distinguish the more common western harvest mouse from the endangered salt marsh harvest mouse. No small mammals were captured in the tidal lagoon area, presumably because of lack of tidal wetland vegetation (e.g., cord grass and glasswort).

Several bat species that are federally listed as species of concern or are protected by the Migratory Bird Treaty Act could occur in the project area. Hollow snags are important roosting habitat for bats. Fresh emergent marsh, including associated open water (e.g., reservoirs) habitat, is also important because it offers

a permanent water source, food, and cover to a variety of wildlife species. Marshes generally support high insect densities, and therefore are also important foraging areas for many bats.

Exhibit 2: Final Environmental Impact Statement

3.2.3 Fisheries

This section discusses the current setting of the fisheries resources in the study area. The purpose of this information is to establish the existing environmental context against which the reader can comprehend the environmental changes caused by the proposed action. The environmental setting information will ultimately be directly or indirectly relevant to the subsequent discussion of impacts.

3.2.3.1 Existing Conditions

In anticipation of the restoration of Big Lagoon, the ecological attributes of the study area have been examined extensively. The following background documents, which were prepared by NPS to provide a base of knowledge pertaining to fisheries in the lagoon and the upstream reaches of Redwood Creek, are listed below.

- *Big Lagoon Wetland and Creek Restoration Project, Muir Beach, California, Part 1. Site Analysis Report* (Philip Williams & Associates et al. 2003)
- *Redwood Creek Watershed Assessment. Draft. Chapter 1: Watershed* Characterization (Stillwater Sciences 2005a)
- *Long-term coho salmon and steelhead trout monitoring program in Coastal Marin County – Redwood Creek summer basinwide monitoring report.* (Reichmuth et al. 2006)
- Summary of Fish Surveys at Big Lagoon and Tributaries (With Emphasis on Tidewater Goby (*Eucyclogobius newberryi*), Marin Co., Golden Gate National Recreation Area (Fong 2006)

Each of these documents and several others describe at length the existing conditions for key fisheries within the study area. What follows is a summary of these descriptions; for a more detailed analysis please refer to the documents themselves.

Aquatic Habitat

The Redwood Creek watershed encompasses 8.9 square miles extending from the peaks of Mt. Tamalpais, through Muir Woods National Monument, to the Pacific Ocean at Muir Beach. Ninety-five percent of the watershed is owned and managed by three public agencies: MMWD, California Department of Parks and Recreation (Mt. Tamalpais State Park), and the NPS (Muir Woods National Monument and GGNRA).

The project area is located at Big Lagoon, at the terminus of the Redwood Creek watershed. Big Lagoon itself is a tiny intermittently tidal lagoon with an open

water surface area that fluctuates between 0.1 and 1.7 acres annually (Philip Williams & Associates et al. 2003). This is a fraction of the historic extent of open water habitat on the site. Based on historic maps and sediment cores, the Big Lagoon complex was predominantly a freshwater/brackish marsh consisting of roughly 12 acres of open water, 13 acres of emergent wetlands, and 5 acres of beach dunes (Philip Williams & Associates et al. 2003). From 1853 to the present, a variety of human and accelerated natural processes (including channelization, levee construction, agricultural filling, and parking lot construction) impacted the Big Lagoon environs. Currently 6 feet of fill overlays the historic freshwater lagoon elevation.

Species

The Redwood Creek watershed is known to harbor at least nine native fish species, including coho salmon, steelhead trout, Sacramento perch, Sacramento blackfish, topsmelt, threespine stickleback, prickly sculpin, coast range sculpin, riffle sculpin, Pacific staghorn sculpin, and starry flounder. Sacramento perch and Sacramento blackfish are native California fish but would not normally inhabit Redwood Creek. Both of these species have been introduced into the Green Gulch watershed. Two nonnative fish species, striped bass and yellowfin goby, have also been recorded. All of these fish species have been documented in the watershed during investigations of Redwood Creek and its estuary from 1992 through the present.

In addition to the species surveyed in the background documents cited above, NPS has observed Sacramento blackfish and yellowfin gobies in the tidal lagoon. Special-status fish species are discussed in more detail below.

Coho Salmon and Steelhead Trout

Redwood Creek supports critical habitat for two special-status fish species listed by NMFS: the Central California Coast Distinct Population Segment (DPS) steelhead trout and Central California Coast Evolutionary Significant Unit (ESU) coho salmon. The Central California Coast DPS of steelhead trout is listed as federally threatened. The Central California Coast ESU of coho salmon is listed as federally endangered (70 FR 37160, June 28, 2005) and as a species proposed endangered; in addition, the project site has been designated as essential fish habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act. Redwood Creek watershed is one of four watersheds in Marin County that supports coho salmon (California Department of Fish and Game 18, 2002). Redwood Creek is considered one of the most productive and restorable basins for anadromous salmonid habitat in Marin County. During surveys from the years 2000 to 2002, coho salmon were found consistently in the creek (California Department of Fish and Game 44, 2004).

As identified above, NMFS classifies and lists salmon by ESU and trout by DPS. To be considered an ESU/DPS, a population or group of populations must be substantially reproductively isolated from other populations, and contribute substantially to the ecological or genetic diversity of the biological species.

Genetic analyses have been conducted using coho salmon tissue sampled from different watersheds in each ESU (Hedgecock 2002) and from the Central California Coast ESU area (Garza and Gilbert-Horvath 2003). A phylogeographic tree derived from these analyses indicates that coho salmon found in Redwood Creek are a distinct subgroup that does not show close genetic relationship with any other coho salmon subgroup in the Central California Coast ESU (Hedgecock 2002; Garza and Gilbert-Horvath 2003).

According to NMFS, essential habitat features for the various life stages of steelhead and coho salmon include the following:

- juvenile rearing areas;
- juvenile migration corridors;
- areas for growth and development to adulthood;
- adult migration corridors; and
- spawning areas.

Juvenile Salmonid Rearing and Areas For Growth and Development

One of the primary limiting factors to salmonid production in the Redwood Creek watershed is a lack of juvenile rearing habitat. A basin-wide habitat inventory was conducted by NPS in 1995 to describe in-stream and riparian habitat conditions from the mouth of Redwood Creek into Muir Woods. When water is present, Redwood Creek supports juvenile coho and steelhead of various ages throughout the year. Lack of secondary channels and backwater areas, woody debris, exposed tree roots, or other features that can provide refugia from high velocity flows, limits summer and winter salmonid rearing habitat in the Redwood Creek, upstream of Pacific Way. Key sections in Redwood Creek that lack good rearing habitat include human-altered sections of Redwood Creek and Fern Creek in Muir Woods National Monument.

It is important to have good rearing habitat distributed throughout the watershed. The inability of altered stream reaches to provide adequate rearing habitat results in displacement of juveniles to downstream areas. This places a burden on already crowded downstream areas and reduces the overall salmonid carrying capacity of the watershed. Researchers investigating winter habitat use in the Lagunitas Creek watershed found low site fidelity in a high gradient stream lacking floodplain features, whereas a low gradient area with adjacent side channels had high use during the winter (Sloat pers. comm. 2006).

Downstream of Pacific Way, Redwood Creek and Big Lagoon provide generally poor salmonid rearing habitat. Under normal to dry years, portions of this area are dry. Even when water is present, the tidal lagoon lacks sufficient cover for juvenile salmonids. Past flood control activities have resulted in localized losses of instream cover between the Pacific Way Bridge and parking lot. Recorded water temperatures at the lower Redwood Creek pedestrian bridge are typically below 20°C (Fong 2002) which are below the reported growth thresholds limits noted in McMahon (1983).

For many small coastal streams with flashy streamflows (such as Redwood Creek), poor winter survivorship can be a major factor affecting population size. Understanding the winter survivorship of this stream compared to similar systems can help determine whether winter habitat is limiting. For coho juveniles born in 2005, NPS estimated a winter survivorship of 11–20% based on the ratio between trapped outmigrating coho and summer basinwide estimates of juveniles (National Park Service unpub. data 2006, Reichmuth et al. 2006). By comparison, four tributaries of the Russian River (Sonoma County) had winter survivorship of hatchery coho over the same time period from between 1–25% (Obedzinski pers. comm. 2006).

Migration Corridors and Spawning Areas

Current conditions are likely adequate for movement of juvenile fish both upstream and downstream under most flow conditions. Previous trapping data indicate that most outmigration activity of juvenile salmonids occurs in the spring and early summer. Adult coho and steelhead typically migrate upstream during the late winter through spring, with run-back steelhead seen as late as late-April and May. Since upstream movements are associated with storm events, no barriers are likely to occur within the project area that could impede upstream adult fish passage. However, there is an absence of large pools that could function as holding sites for adult salmonids before their journey upstream. In coho spawner surveys conducted from the winter season of 1997–1998 through 2001–2002, no redds have been reported within the project area. Most redds are observed more than 1 mile upstream of Pacific Way.

Tidewater Goby

The tidewater goby is a small benthic fish (<50 mm standard length) found in coastal waters in California from San Diego to Del Norte counties. It is listed as federally endangered and as a state species of special concern. It is most commonly found in slightly brackish waters (0–10 parts per thousand), although experimental studies have shown the goby to tolerate hypersaline conditions for short periods (Swift et al. 1989). While tidewater goby has not been observed at the site, it is possible that Big Lagoon was a historic home of the tidewater goby, given that it is a species endemic to coastal lagoons along the California coast. Currently, Rodeo Lagoon and lower Tomasini Creek, within the GGNRA, are the only locales within the Bay Area counties that have extant goby populations. In summary of Darren Fong's 2006 analysis of potential habitat suitability for tidewater goby, the absence of this fish from Big Lagoon is likely the result of the small and ephemeral nature of brackish lagoon habitat in this watershed and its limited recolonization capabilities.

3.3 Cultural Resources

3.3.1 Introduction

Leo Barker, NPS archaeologist, and Jack Meyer, geoarchaeologist at the Sonoma State University Anthropological Studies Center, have undertaken extensive cultural resources surveys for the area of potential effect (APE) for the Big Lagoon Wetland and Creek Restoration Project. Barker et al. (2005) and Meyer (2002, 2003, 2005) have provided the basis for the cultural resources analysis contained in this Final EIS/EIR. Barker's 2005 report provides in-depth descriptions of the known resources within the APE as well as background settings for precontact, ethnographic, historic, and cultural landscape features within the APE and surrounding area.

This section provides a brief summary of the precontact period, history, and ethnography of the site, and then gives a summary of the significant or potentially significant resources that have been identified within the APE: CA-MRN-333 (Muir Beach Site), CA-MRN-674 (the Pelican Site), and the Fan Site.

3.3.1.1 Area of Potential Effect

Barker used an APE for the project that combined areas of direct and indirect impacts (Barker 2005). The APE for direct impacts includes all of the alternatives for the proposed project and the entire physical space encompassed within those alternatives. The indirect APE is described by Barker et al. (2005) as

> …a somewhat larger historic preservation APE defined for the purposes of the NHPA, and scaled to capture the full historic boundary of the ranches whose component parts may be within the narrower project impact area. The historic preservation based definition has also been used to frame the cultural resource survey conducted for the Big Lagoon Wetland and Creek Restoration Project.

The indirect APE was created to allow analysis of a broad spectrum of all cultural resources, including precontact, historic, and cultural landscape resources.

3.3.1.2 Precontact Setting[1]

Native people lived throughout present-day Marin and southern Sonoma Counties for an estimated 7,000 years prior to European colonization (Duncan 1989). At the point of contact with Europeans, the Redwood Creek watershed was apparently controlled by the Huimen, the southernmost of about fifteen

[1] The information presented regarding precontact and historic setting has been adapted from Stillwater Sciences (2005).

Coast Miwok tribes (see, for example, Bennett 1998). Archaeological sites, including at least three shell middens on the perimeter of the former Big Lagoon at Muir Beach, attest to its Coast Miwok heritage (Meyer 2003), and prominent nearby places bear names derived from the Coast Miwok language. For example, the name "Tamalpais" is a Spanish adaptation of a Coast Miwok word meaning "west hill" or "coast hill."

The Coast Miwok managed the land with fire, burning large areas to drive—and sometimes kill—game animals, and to manage vegetation for grazing, travel, camping, the growth of desirable species, and the collection of acorns and seeds (Duncan 1989; Marin Municipal Water District 1995). Over thousands of years, these management practices shaped the distribution and species composition of native plant communities. Anecdotal accounts suggest that hillsides were dominated by native perennial bunch grasses, with trees and woody vegetation occurring mainly in ravines and canyons. For example, after ascending slopes near Big Lagoon, Lieutenant Henry Wise of the U.S. Navy reported in 1849 that "there was no timber to be seen, and except the stunted undergrowth netted together in valleys and ravines, all was one rolling scene of grass, wild oats, and flowers" (e.g., Toogood 1980). By the time of this account, in the late 1840s, the onset of cattle grazing in the region was probably already affecting vegetation distributions locally (see next section). It nevertheless seems safe to assume that, at the coarse scale of the observation, landscape conditions were still largely reflecting the prolonged influence of Coast Miwok culture, rather than exhibiting the effects of the recent shift in management practice.

3.3.1.3 Historic Setting

Cattle Grazing and Timber Harvesting

The Spanish founded the Presidio at San Francisco in 1776 and began establishing the mission communities that ultimately supplanted the tribal cultures of the Coast Miwok and other indigenous Bay Area peoples. Parts of the Redwood Creek watershed may have been grazed by cattle and harvested for timber starting in about 1817, with the formation of Mission San Rafael Arcangel, which is reported to have had 8,000 cattle, horses, and other grazing animals at its peak of productivity (Munro-Fraser 1880).

Cattle grazing and timber harvesting intensified after 1838, when the Redwood Creek watershed was officially deeded to William Richardson (Auwaerter 2005), as part of a grant that included much of the Marin peninsula (19,571 acres or 7,920 hectares in all). Richardson named the area "Rancho Saucelito" (using the Spanish word for "willow," from which "Sausalito" is derived) and began grazing longhorn cattle on it. According to an 1847 census, as many as 2,800 head—the largest herd in Marin County—roamed the open range of Richardson's rancho. Richardson and his neighbor, David Reed, of the Rancho de Corte Madera del Presidio, harvested redwoods and other trees from the east side of Mt. Tamalpais, and, as partners, opened the first timber mill in Marin County in the 1840s (Golden Gate National Recreation Area 2003). By the 1850s, all of the

easily accessible large timber on the bay-side of the mountain had been harvested. Timber harvesters began to focus on old growth redwoods from the hills around Bolinas Lagoon and the Lagunitas Creek watershed, to the north of Redwood Creek, while continuing to harvest smaller trees along Richardson Bay for cordwood to heat homes and brick kilns. Logging had spread to the ridges above Muir Woods by the late 1800s. By the early 20th century, most of the old growth redwoods in the region had been harvested. Exceptions were the stand in present-day Muir Woods and 1,300 acres in Kent Canyon, which was selectively logged by tractors by its agricultural owner in the 1960s prior to sale of the land to State Parks (Philip Williams & Associates 2000).

Dairy Farming

In 1856, the Richardson family sold Rancho Saucelito to San Francisco financier Samuel Throckmorton, who subdivided parts of it into 500- to 1,500-acre parcels for dairy farming (Auwaerter 2005). Demand for dairy products was growing with San Francisco's expanding population, and by 1880, the Rancho Saucelito had been carved into 24 dairies, most of which were leased by Portuguese and Swiss immigrants. The beach was the center of the community, with farmhouses scattered throughout the valleys under an agrarian culture that reflected the European heritage of the immigrants (Philip Williams & Associates et al. 2003).

In 1889, 6 years after Throckmorton's death, the rancho was acquired by the Tamalpais Land and Water Company (Auwaerter 2005). Much of the land was sold for tenant dairy farming. The biggest were the Dias (or Hill) Ranch, which extended from Homestead Valley across Dias Ridge to the Pacific Ocean; the Brazil brothers' ranch, which extended from Frank Valley up Mt. Tamalpais past the Dipsea Trail; the Silva Ranch, located in lower Frank Valley; and the Bello Ranch (a.k.a., Golden Gate Dairy), which included Green Gulch, Muir Beach, and a portion of Frank Valley (Livingston 1994; Spitz 1997; Baron 2001; summarized in Jebens 2001). Many of the tenant dairy farms continued operating into the mid-twentieth century.

Other Agricultural Uses

The dairies of Green Gulch and Frank Valley were eventually converted to other agricultural uses. In Frank Valley, Amadeo Banducci Sr. began leasing portions of the Silva dairy in the 1930s for flower and vegetable farming (Livingston 1994). In 1948, Banducci purchased the property and operated the entire parcel as a flower farm (Culp 1998). Three years earlier, Green Gulch and Muir Beach had been purchased by George Wheelwright, who raised beef cattle. Wheelwright planted New Zealand grasses on new pastures that he had reclaimed by building levees in the Big Lagoon area along Redwood Creek. In an effort to increase the area available for grazing, he burned and chained the pervasive shrub vegetation, and, for 3–4 years in the late 1950s, sprayed herbicides by helicopter over his property. By 1969 Wheelwright had donated Muir Beach to the State Park system, and by 1972 had sold Green Gulch to the San Francisco

Zen Center under terms that would keep the area in agriculture with only minimal construction of buildings and facilities (Jebens 2001).

Railroads, Roads, and Other Infrastructure

The natural beauty and resources of Mt.Tamalpais and the Marin Coast have attracted recreationists from San Francisco and other nearby areas since the late 1800s (Auwaerter 2005). The first ferry service to Marin began in 1855, providing transportation from San Francisco to Point San Quentin. Ferry service to Sausalito was added in 1868. The area's first wagon road, completed in 1870, extended from Sausalito to Bolinas, along the present grade of Hwy 1. The Eldridge Grade road, from San Rafael to the summit of Mt Tamalpais, was completed in 1879.

Recreation at the peak expanded in 1896, with the opening the Mill Valley and Mt. Tamalpais Scenic Railway by the Tamalpais Land and Water Company—which had backing from local financiers Sidney Cushing and Albert Kent. Dubbed "The Crookedest Railroad in the World," it carried tourists up 8.2 miles (13.2 km) of track, through 281 curves, from Mill Valley to the East Peak of Mt. Tamalpais. Once at the top, tourists could climb to the Marine Exchange lookout on East Peak, visit the Weather Bureau station (opened in 1898) and follow hiking trails to outlying areas.

In 1907, Albert Kent's son William built a spur to connect Muir Woods to the Mill Valley and Mt Tamalpais Scenic Railway line. In 1913, the railroad was incorporated and named the Mt. Tamalpais and Muir Woods Railway.

Muir Woods Road was built in 1893, and from roughly 1905 to 1910, was extended to Frank Valley (Jebens 2001). Pacific Way was connected to Muir Beach in 1908. In 1925 and 1926, the Frank Valley and Muir Woods Roads were upgraded (Jebens 2001). Panoramic Highway was opened in 1928.

The "Great Tamalpais Fire" of 1929 put an end to the railroad, which had been in decline due to the rising popularity of automobiles (Auwaerter 2005). The railroad was abandoned in the summer of 1930, and its rails, ties, engines, cars, and other equipment were removed from the watershed.

In 1937, when the Golden Gate Bridge was completed, annual visitation to Muir Woods tripled, to more than 180,000 visitors per year. By 1947, an estimated total of 58 miles (93 km) of roads and trails had been constructed in the watershed, many for ranching purposes (Pacific Watershed Associates 2002). An additional 5 miles (8 km) of roads and trails were built between 1953 and 1965, and 4 more miles were added between 1971 and 1982 (Pacific Watershed Associates 2002).

Hunting and Hiking

In the mid 1800s, Redwood Creek owner William Richardson and his family and friends hunted extensively in the area. Accounts from his hunting expeditions tell of abundant elk, deer, bears, and mountain lions on the slopes of Mt. Tamalpais (Golden Gate National Recreation Area 2003). After acquiring the land and leasing parcels of it for dairy farming, Samuel Throckmorton lined much of his remaining property with fences, guarding it for personal use as a game refuge and allowing access to only a select group of friends (Auwaerter 2005).

Hunting became increasingly popular as public access expanded after Throckmorton's death in 1883. However, efforts to reserve the land for private recreational use and limited public access continued as members-only hunting and outdoor clubs began leasing large sections of the mountain slopes from local ranchers. By the end of the 1880s, most of the large game animals had been wiped out (Golden Gate National Recreation Area 2003). With large predators gone, the deer population grew and became a chief target of hunters.

As access improved with increasing infrastructure, hikers inevitably transformed the mountain into an outdoor recreation center (Auwaerter 2005). The Tamalpais Club (founded before 1880) maintained a summit register on East Peak. The first volume, spanning 1880–1887, records more than 850 names of men, women, and children from throughout the United States and Europe (Golden Gate National Recreation Area 2003). In the 1890s and early 1900s, several hiking clubs were formed (Auwaerter 2005). Among them were the Sight-Seers in 1887, the Cross-County Club in 1890, the California Camera Club in 1890, the Columbia Park Boy's Club in 1894, the Sempervirens Club in 1900, the Sierra Club Local Walks Committee in 1906, the Tourist Club in 1912, and the California Alpine Club in 1914. These clubs organized hikes, built and maintained trails, established camps, and built a "Trailman's Cabin" at Bootjack Camp. In 1904, hikers from San Francisco's Olympic Club held a foot race from Mill Valley to the Dipsea Inn in Bolinas, along the Lone Tree Trail. This was the first Dipsea Race, a still-popular annual event.

The first trail map of the mountain, published in 1898, shows several trails—the Lone Tree (a portion of today's Dipsea), Cataract, Kent, Throckmorton, Bootjack, and West Point (now Rock Spring) trails—which still exist today. By the 1920s, hiking and overnight camping on the mountain were so popular that the San Francisco Examiner newspaper published daily weather predictions for Mt. Tamalpais. Hiking continues to be an important activity in the watershed today.

Commercial Recreation

Muir Beach has long been a popular tourist stopover. In 1919, Antonio Bello, a Portuguese dairyman, established a hotel at Muir Beach (Golden Gate National Recreation Area 2003). The hotel later burned down and was replaced in 1928 by a tavern and small cabins. The tavern closed in the 1960s after it came into

ownership by State Parks and was torn down by State Parks over protest by local residents. All of the cabins were also torn down. Accommodations at Muir Beach are now provided by the Pelican Inn bed and breakfast, which was built on a fill pad in the 1970s.

Conservation Efforts

By the end of the 1800s, recreationists had begun supporting efforts to preserve the area's natural and scenic resources from impending urban encroachment. A local water company had identified Redwood Canyon as a potential reservoir site, and housing and road developers were becoming increasingly interested in the as yet untouched hillslopes of Mt. Tamalpais. The watershed was defended by a succession of local and regional conservation-minded groups, including the Mt Tamalpais Forestry Association, the local hikers of the "Hill Tribe," the Mt. Tamalpais National Park Association, the Tamalpais Conservation Club, the Sempervirens Club, the Sierra Club, and the California Club. William Kent, namesake of Kentfield, became a key participant in the conservation efforts. In 1905, he purchased Redwood Canyon and, in December 1907, donated much of it to the federal government. Just days after Kent's grant, President Theodore Roosevelt invoked the Antiquities Act and designated Redwood Canyon a national monument, with the name "Muir Woods," in honor of the famous conservationist and writer. Kent eventually went on to serve in Congress and introduce the legislation that established the National Park Service in 1916.

The establishment of Muir Woods National Monument was the first in a series of notable conservation actions in the Redwood Creek watershed. In 1912, the Marin Municipal Water District was formed to protect the natural resources of land in the upper part of the watershed and use it to provide water to the citizens of Marin. In July 1917, after years of conflict between hunters and hikers, the Mt. Tamalpais Game Refuge was established, ending hunting on most of the mountain—as well as in the Lagunitas Creek watershed, from Alpine Lake downstream to the outlet. In 1928, Mt. Tamalpais State Park was established after three decades of pressure from conservation groups. Only 200 acres at its inception, Mt. Tamalpais State Park has since acquired, among other holdings, the Dias and Brazil dairy farms (in the 1960s) and has grown to include more than 6,300 acres of land on the mountain. The Golden Gate National Recreation Area was founded in 1972. The National Park Service began purchasing existing and defunct farms and incorporating them into GGNRA. By 1995, cattle grazing and farming within the watershed had been completely phased out, and the GGNRA had grown to include Muir Beach, Coyote Ridge, a portion of Dias Ridge, and the lower parts of Frank Valley.

3.3.1.4 Known Resources in the APE

Resources Determined Not to Be Significant or Potentially Significant

The following cultural resources were evaluated but were determined not eligible for listing in the National Register of Historic Places (NRHP) by Golden Gate NRA staff and as such are not discussed further. These conclusions concerning National Register eligibility remain to be concurred with by the California State Historic Preservation Officer.

- **Monterey Pine and concrete curb at Hwy 1 and Pacific Way.** These two features at the corner of Hwy 1 and Pacific Way were determined not to be contributing features to the Golden Gate Dairy complex discussed below.
- **Banducci Flower Farm.** This site, within which the Upper Banducci Fields sediment disposal site is located, has been determined to be of local historic significance but is not considered eligible for NRHP listing.
- **Green Gulch Zen Center/Wheelright Ranch.** The project site and the Zen Center located east of the project site were both part of Wheelwright Ranch. However, the remaining elements of Wheelright Ranch are few, and the resource lacks integrity and therefore is not eligible for listing in the NRHP.
- **The Tavern (i.e., the Muir Beach Tavern Farallones East, Denocarlo Naval Base).** The tavern that was historically located near the beach has been mostly removed; the remnants lack integrity, and therefore the site is not eligible for listing in the NRHP.
- **Modern corrals, cattle chute.** These structures, located near the corner of Pacific Way and Hwy 1, are not old enough to be considered historic.

For information regarding all resources evaluated; in-depth precontact, ethnographic, and historic settings; and detailed results of the investigations, please refer to Barker et al. (2005) and Meyer (2002, 2003, and 2005.)

CA-MRN-333

According to the research conducted by Baker and Meyer, this is a relatively intact precontact archaeological site located within the APE. This shell midden site was first recorded by Nels Nelson in 1909 and later listed on the NRHP in 1979. Boundaries of this site have been well defined as a result of hand augering and surface survey (Barker et al. 2005). Project activities are anticipated to avoid the site; as a result, no impacts are anticipated as a result of the project.

CA-MRN-674

Recent archaeological investigations at CA-MRN-674 (P-21-2615), also known as the "Pelican Site," have confirmed the presence of intact precontact archaeological deposits between 110–140 cm (3.6–4.6 feet) below the existing ground surface, with a thickness of 40–65 cm (Psota 2006). The archaeological deposit contained a diverse array of shellfish remains, dietary faunal remains, chert and obsidian flaked stone artifacts, a small diagnostic obsidian projectile point, and two small chert drills. Based on the quantity and variety of the artifact assemblage and integrity of the deposit, Psota (2006) concludes that CA-MRN-674 is likely to yield important information in prehistory and therefore appears eligible for listing in the NRHP under Criterion D.

The Fan Site

The fan site has been locally known for years, but was first formally recorded in 2002 (Meyer). The boundaries of the site have been fairly well established through survey and limited subsurface investigation (Meyer 2002, 2003). There are both surface and buried components to this precontact shell midden. Cultural materials present include a variety of shellfish remains, dietary faunal remains, heat-altered rock, and a few pieces of chert flaked stone. A single carbon date, approximately 230 Before Present, from the site places it in the late period of prehistory. Additional archaeological investigation is needed to formally make a determination of the site's eligibility for listing in the NRHP under Criterion D. However, it is likely that the site would be determined eligible due to the scarcity of such sites along the Marin County coast and the variety of artifacts present at the site.

Golden Gate Dairy Ranch Complex

The Golden Gate Dairy is a significant historic property that has been determined by Golden Gate NRA staff to be eligible for listing in the NRHP for both its structures and cultural landscape (Barker et al. 2005). Golden Gate will be seeking concurrence with this determination from the California State Historic Preservation Officer. This property is located adjacent to the upstream project elements in the project APE and on the east side of Hwy 1.

Ethnographic Resources

Research within the APE has resulted in the determination that the project area was used extensively by cultural groups such as the Coast Miwok in the precontact period and Azorean dairy ranchers in the historic period. The activities of these groups helped to shape the landscape of Big Lagoon, and project activities could potentially cause indirect effects on the heritage and cultural

values of the groups involved in the history and prehistory of the project area (Barker et al. 2005).

Cultural Landscapes

Cultural landscapes are the result of the long interaction between people and the natural landscape. Shaped through time by historic and precontact land-use and management practices, as well as culture, politics and property laws, levels of technology, and economic conditions, cultural landscapes provide a living record of an area's past—a visual chronicle of its history. NPS has identified two cultural landscapes that may be affected by the proposed project: Golden Gate Dairy Ranch Complex, portions of which are clearly visible from the project area and physically adjacent to the APE. The other cultural landscape identified within the APE is that associated with the Coast Miwok, which is discussed under Ethnographic Resources, above. However, it does not appear that the Coast Miwok cultural landscape has retained its integrity through time from the point of contact to the present day due to the numerous historic and modern modifications of the area.

Precontact Archaeological District

Recent archaeological investigations and completed identification efforts (Psota 2006) at CA-MRN-674, have resulted in the determination that the site is eligible for listing in the NRHP, under Criterion D. Previous identification efforts at the Fan Site (Meyer 2002, 2003, 2005) have also resulted in the assumption that the site is also eligible under Criterion D.

There is the potential that these precontact archaeological sites, along with previously recorded and NRHP listed CA-MRN-333, could comprise a precontact archaeological district associated with the mouth of Redwood Creek, because sites are eligible for listing in the NRHP. NPS, in consultation with the SHPO, is in the process of determining whether the archaeological sites comprise an eligible district under NRHP. NPS will submit a letter to SHPO with information about the potential archaeological district.

Exhibit 2: Final Environmental Impact Statement

3.4 Social Resources

3.4.1 Recreation and Visitor Experience

To many people, the scenic northern California coast is synonymous with nature-based recreation, and the Muir Beach area is no exception. Diverse recreational and tourism opportunities in the vicinity of Big Lagoon include Muir Beach itself, as well as nearby Stinson Beach, Muir Woods National Monument, about 4 miles inland, and various other open space areas managed by the National Park Service, State of California, and County of Marin (see Figure 3.4.1-1). Open space activities in the larger Muir Beach–Stinson Beach area thus include beach walking, hiking, trail running, mountain biking, horseback riding, birding, and wildlife and wildflower viewing. The Pelican Inn at Muir Beach offers bed-and-breakfast accommodations, and the town of Stinson Beach offers additional dining opportunities. Contemplative retreats are available at the San Francisco Zen Center's Green Gulch Farm facility. Additional coastal recreation access can be found at Point Reyes National Seashore, about an hour's drive to the north.

This section provides additional information on principal recreational opportunities and uses in the immediate project vicinity, and how they fit into the broader regional recreation context. The final discussion describes recreational use patterns in the project area, including recreational visitor motivation in selecting the Muir Beach area as a destination. Note that approximately half of the area proposed for restoration is within NPS's GGNRA, with the remainder owned by the SFZC.

3.4.1.1 Key Recreational Opportunities and Uses in the Project Area

Golden Gate National Recreation Area

Overview

The GGNRA was established in 1972 in response to an identified need to "bring national parks to the people," making national park resources more accessible to city dwellers. With a total area of more than 75,000 acres, encompassing 59 miles of Bay and ocean shoreline that extend from San Mateo County to Tomales Bay in Marin County, GGNRA is one of the nation's largest coastal preserves and one of the largest primarily urban national parks in the world (National Park Service 2006b).

The GGNRA's rich natural resources comprise 19 different ecosystems in seven separate watersheds. The GGNRA is home to as many as 80 rare, threatened, or endangered species, including the coho salmon, California red-legged frog, and northern spotted owl (National Park Service 2006b). One of the park's highlights—and a key draw for visitors from around the world—is the old growth

coast redwood forest preserved at Muir Woods National Monument (see National Park Service 2006c).

GGNRA also includes cultural resources that document the Bay area's complex heritage, including sites at the Marin headlands; the disused federal prison at Alcatraz, occupied by Native American protesters from 1969 to 1971; Fort Point National Historic Site; the Presidio of San Francisco; and Fort Mason. Collectively, these sites chronicle more than 200 years of Bay area history, from prehistoric Native American culture to the Spanish Empire frontier, Mexican Republic, development of American coastal fortifications and maritime expansion, the California Gold Rush, and the growth of San Francisco as an urban center (National Park Service 2006b).

Reflecting the extent and diversity of its holdings, the GGNRA attracts some 16 million visitors each year (National Park Service 2006b).

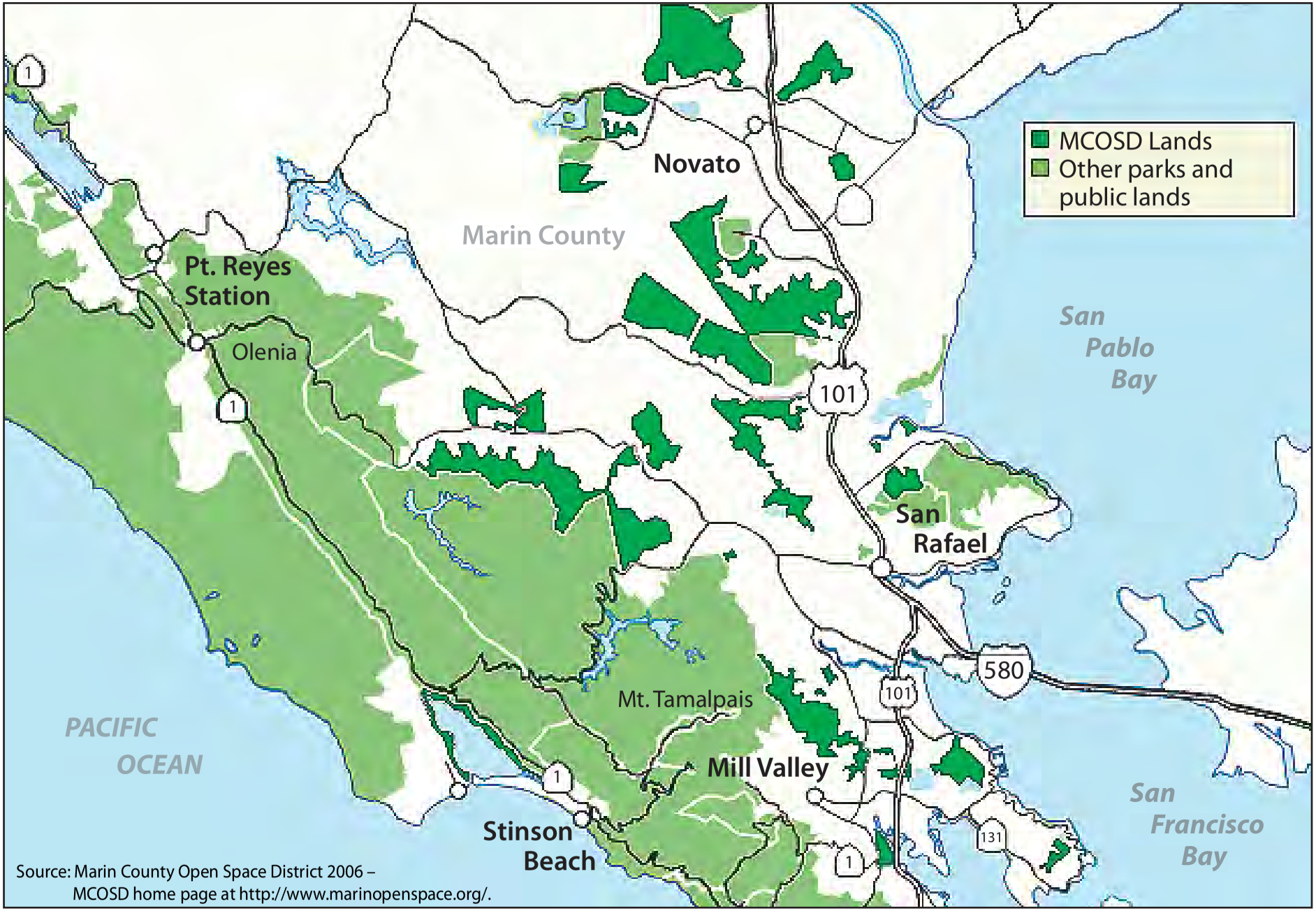
Muir Beach

Muir Beach is one of the GGNRA's most popular destinations, combining easy access with spectacular beach scenery. At present, it serves an estimated ~~440,000~~ 260,000 visitors annually (Bignardi pers comm.).

Muir Beach consists of a sandy coastline at the mouth of Redwood Creek, bordered to the north and south by rugged cliffs. Behind the beach proper are the existing wetland and lagoon areas. The beach is open to visitors year-round, from sunrise to one hour after sunset each day. The nearby Muir Beach Overlook, also part of the GGNRA, provides outstanding panoramic views of the coastline (National Park Service 2006d).

Figure 1-2 shows existing facilities at Muir Beach. These include parking for 175 cars, and a developed picnic area south of the existing parking area, offering tables and grills, along with portable chemical toilets and garbage cans. Three additional fire rings are located on the beach near the south end of the parking lot (National Park Service 2006d).

Activities at Muir Beach include picnicking, beachcombing, dog walking, and birding. Water recreation access is available, and limited ocean swimming is feasible, but no lifeguards are provided, and visitors are cautioned to beware of rogue waves, undertow, and sharks. In addition, bacteriological contamination discourages water contact recreation (see Section 3.1.2, *Water Quality*). To protect wildlife habitat, swimming and wading are prohibited in the lagoon. Pets are permitted on the beach and in the picnic area, but must be on leash in parking and picnic areas, and under voice control or on leash on the beach. Dog management throughout GGNRA is being evaluated through an ongoing federally-sanctioned negotiated rulemaking process and a concurrent NPS environmental analysis (separate from the Big Lagoon project). The outcome of these processes will determine how dogs will be managed on lands under NPS jurisdiction within the project area. More information on this planning process can be found at http://www.nps.gov/goga and http://parkplanning.nps.gov/goga.



Source: Marin County Open Space District 2006 – MCOSD home page at http://www.marinopenspace.org/.

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Figure 3.4.1-1
Marin County Open Space and Parklands

Exhibit 2: Final Environmental Impact Statement

Fires are permitted only in grills and fire rings (National Park Service 2006d).

Muir Beach is adjacent to a County beach located immediately to the north, and offshore areas are part of the Gulf of the Farallones National Marine Sanctuary managed by NOAA.

Regional and Local Trail Network

Several important trails lead to the Muir Beach area, including the Coastal Trail, the Redwood Creek Trail, the Green Gulch Trail, and the Dias Ridge Trail (Figure 3.4.1-2). In general, the regional trails are multi-use routes that serve hikers, equestrians, and mountain bikers, although mountain bike use is restricted or prohibited in some areas, including the Redwood Creek Trail and portions of the Green Gulch Trail (Philip Williams & Associates et al. 2003).

The existing parking lot at Muir Beach provides trailhead access to the Green Gulch Trail and southern portion of the Coastal Trail. However, the other trails are difficult or dangerous to access from the parking lot, primarily due to travel on non-NPS property between NPS trails that terminate on local roads. Connections between the trails are largely absent, although the Green Gulch Trail and southern Coastal Trail merge on the valley floor before connecting to the beach via the existing bridge. Nonetheless, the southern and northern portions of the Coastal Trail are disconnected, and there is no connection from the project area to the Redwood Creek Trail, Dias Ridge Trail, or other trails to the north. The existing trail discontinuities are confusing and potentially dangerous for trail users, who must use the shoulders of narrow roadways such as Hwy 1 to access one segment from another, if they do so at all. Both NPS and the public have expressed the desirability of better trail integration in the project vicinity (Philip Williams & Associates et al. 2003).

Formalized trail access to Muir Beach is available only from the south end of the Muir Beach parking lot, via the existing pedestrian trail and bridge. An informal beach access route that crossed the tidal lagoon was closed in 2003. The beach can also be accessed from the regional trails to the south (Philip Williams & Associates et al. 2003). The existing road along the levee is also heavily used by hikers and equestrians, forming part of a popular loop route.

San Francisco Zen Center

Overview

Established in 1962, the San Francisco Zen Center is one of the largest Buddhist communities outside Asia. It operates three “practice places”—City Center in San Francisco; Tassajara Zen Mountain Center, the first Zen training monastery in the West, in Big Sur’s Ventana Wilderness; and Green Gulch Farm, adjacent to Muir Beach (San Francisco Zen Center 2006b). All three centers offer daily meditation, classes, lectures, workshops, and longer-term monastic retreats. The Zen Center serves a diverse population that includes not only priests and monks,

but also students, lay members of the community, and visitors. The Zen Center also conducts a variety of community outreach programs, including homeless relief, mindfulness training for prison inmates, mindfulness and meditation training for the recovery/rehabilitation community, and social issues advocacy (San Francisco Zen Center 2006b).

Green Gulch Farm

Founded in 1972 as an offshoot of the San Francisco Zen Center's City Center, Green Gulch Farm (also called the Green Dragon Temple) is a Zen monastery and working organic farm. It also offers guesthouse and conference center facilities (San Francisco Zen Center 2006c). Portions of the property are private land located within the GGNRA boundary.

The zendo at Green Gulch Farm offers weekly instruction in meditation methods, monthly 1-day Zen sittings, and quarterly 1-week extended sittings. It also offers extended "practice period" residencies in the spring and fall, and a special 3.5-week intensive instruction in January of each year. The Farm's guest student program offers short-term (1–6 weeks) residencies for students who wish to explore Zen practice through full participation in the life of the community. Guest students take part in all activities, including sitting meditation, services, work, informal study, and group meals (San Francisco Zen Center 2006c).

Green Gulch Farm also offers a residential apprenticeship in organic gardening and farming methods. The apprenticeship combines an emphasis on meditation practice and Buddhist study with hands-on experience in organic gardening/farming techniques; apprentices are expected to follow a daily schedule of meditation and work. Work and seminar topics include a variety of topics, such as soil fertility and soil preparation; sowing, transplanting, cultivating, and harvesting vegetable crops; raised-bed flower, herb, and fruit culture; composting; care of perennial fruit crops and ornamental plants; integrated pest management techniques; farm management; and distribution via farmers' markets (San Francisco Zen Center 2006c).

Pelican Inn

The Pelican Inn is located on private land adjacent to GGNRA at Muir Beach. A local landmark and highly rated bed and breakfast, it offers guests an atmospheric 16th-century English country inn and pub experience. The Pelican Inn has seven guest rooms furnished with antiques. It also has a pub/restaurant that offers dining, as well as special event rooms appropriate for weddings and other private gatherings for as many as 100 people (Pelican Inn 2006).

Equestrian Uses and Facilities

Equestrian use is a well-established recreational activity in southern Marin County, and equestrian use is established in three locations within GGNRA southern Marin lands. As identified above, most of the regional trails in the

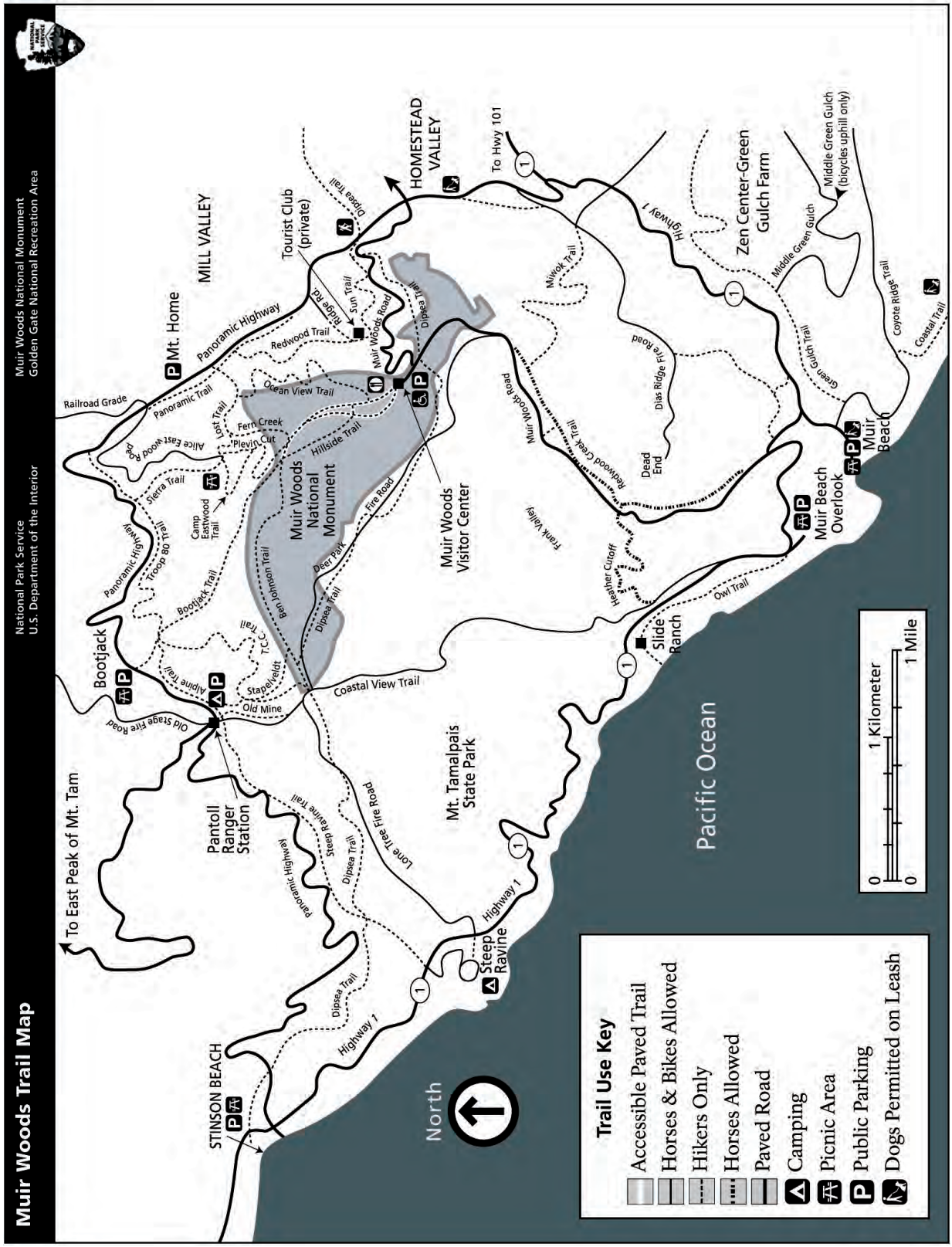

Figure 3.4.1-2
Trails in the Vicinity of Muir Beach

Jones & Stokes

Exhibit 2: Final Environmental Impact Statement

project vicinity are multi-use facilities that equestrians share with hikers and mountain bikers, although mountain bike use is restricted or prohibited in some areas (Philip Williams & Associates et al. 2003). Equestrians also make heavy use of local trails in the project vicinity, in particular the "loop route" accessed via the levee road.

The former Golden Gate Dairy facility, an NPS site located within GGNRA at the intersection of Pacific Way and Hwy 1, is currently used by local equestrians (Figure 1-3). Managed by Ocean Riders under permit, it offers boarding and short-term paddock use and serves as a trailhead for equestrian outings, including group trail rides. Manure from the Golden Gate Dairy is supplied to Green Gulch Farm for use in their organic farming operations. The Golden Gate Dairy also plays a broader role as a community center; it currently accommodates the local mobile veterinary clinic, and in the past has been used as a County bookmobile stop and currently houses activities, equipment, and vehicles of the Muir Beach Volunteer Fire Department (Philip Williams & Associates et al. 2003).

In addition, Green Gulch Farm makes some of its facilities available to equestrians, including Ocean Riders as well as visiting equestrians, particularly riders passing through the area from other stables in the GGNRA. These include the "small paddock," located at the southeast corner of Hwy 1 and Pacific Way on the project site; Field 7, located on the easternmost portion of the project site, which currently provides pasturage for four horses; and some of the farm's hillside areas (Figures 1-2 and 1-3). During the summer, the fenced riding ring near the small paddock is also available for equestrian use (Philip Williams & Associates et al. 2003). Both the small paddock and riding ring are too wet to use in seasons other than summer, due to the high water table.

3.4.1.2 Recreational Use Patterns in the Project Area

Recreational visitors in the Muir Beach area comprise a diverse mix of local and regional residents, tourists in the area for short visits, and longer-term guests at Green Gulch Farm. In a 2003 survey of Muir Beach users, most respondents (94%) identified themselves as from the United States; of those, 74% were from California, with 6% of usage generated by the local Muir Beach community and an additional 8% of visitors identifying as residents or guests at Green Gulch Farm (Manning and Budruk 2003). Overall, an estimated 70% of usage at Muir Beach is by Bay Area residents, but the Muir Beach area's proximity to other well-known tourist draws means that it is also heavily used by interstate and international tourists—surveys suggest that as many as 20% of visitors combine a visit to Muir Beach with a visit to nearby Muir Woods National Monument in the same day (Philip Williams & Associates et al. 2003).

Most (93%) visitors access the site by vehicle (car, truck, van, or sport-utility vehicle [SUV]). A small percentage arrive on foot (4%), by bicycle (1%), or by other means (Manning and Budruk 2003).

Recreational visitor surveys indicate that visitors have a wide range of motivations for choosing Muir Beach. Consistent with the breakdown for local/Bay Area/out-of area usage summarized above, these include:

- visiting the beach, coast, or ocean—56.9%
- hiking or jogging—23.4%
- general rest and relaxation—20.7%
- picnicking—14.4%
- seeing views from the mountains—10.4%
- seeing redwood trees—7.5%
- seeking solitude—6.1%
- going for a drive—3.1%
- biking, including mountain biking—2.7%
- nature study—2.0%
- surfing—0.9% (Philip Williams & Associates et al. 2003).

The beach and trails in particular are key resources for local residents (Philip Williams & Associates et al. 2003). Surveys suggest that more than half of the site's users are returnees, and many users report repeated visits to the site (Manning and Budruk 2003), reflecting their loyalty to a recreational resource that meets their needs.

3.4.2 Traffic and Circulation

This section presents standard traffic terminology; discusses patterns of visitor and local-user access to Muir Beach; and describes the transportation network that provides access to the site. Since visitors primarily access the site by vehicle, with a smaller number accessing the site on foot, by bicycle, or on horseback (Manning and Budruk 2003), and the proposed project is not expected to affect rail transport, air traffic, or mass transit, this section focuses on roadways along with pedestrian, bicycle, and equestrian access routes.

3.4.2.1 Traffic Terminology

Following are definitions of key terms used in this section, based on materials published by the Transportation Research Board (2000) and Caltrans (1999).

The quality of service provided by a roadway or intersection is usually measured in terms of three parameters.

- **Level of service (LOS):** A qualitative measure describing operational conditions within a traffic stream, based on service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience.
- **Volume to capacity (V/C) ratio:** The number of vehicles that travel on a transportation facility divided by the full vehicular capacity of that facility (the number of vehicles the facility is designed to convey).
- **Delay:** The additional travel time experienced by a vehicle or traveler because of inability to travel at optimal speed, and/or stops due to congestion or traffic control.

Table 3.4.2-1 shows the relationship between V/C ratio, delay, driving conditions, and LOS.

Table 3.4.2-1. V/C Ratio, Delay, and Traffic Flow Conditions for LOS Designations

LOS	Approximate Maximum V/C	Average Delay (seconds per vehicle)		Traffic Flow Conditions
		Stop-Controlled Intersection	Signalized Intersection	
A	0.3	≤10	≤10	Free-flow operations; vehicles unimpeded in ability to maneuver in traffic stream.
B	0.5	11–15	11–20	Reasonable free-flow conditions; only slightly restricted ability to maneuver.
C	0.7	16–25	21–35	Flows still near free-flow speed but noticeably restricted ability to maneuver.
D	0.9	26–35	36–55	Speeds begin to decline; maneuverability limited and queues begin to form.
E	1.0	36–50	56–80	Operation at capacity of roadway; maneuverability extremely limited and queues form with any disruption.
F	>1.0	>50	>80	Failure conditions indicating breakdowns in vehicular flow with long queues forming at breakdown points.

Sources: CalTrans 1999 (V/C ratio and flow conditions); Transportation Research Board 2000 (delay).

Following are terms describing the types of roadways in the project area.

- **Freeway:** A multilane divided highway with a minimum of two lanes in each direction and full access control, with no interruption in traffic flow. Freeways are used exclusively by vehicular traffic.
- **Highway:** A roadway with two or more lanes that is not completely access-controlled, and may have at-grade crossings and/or occasional traffic signals. Multilane highways may be divided. Two-lane highways are typically undivided. Highways may accommodate bicycle traffic.
- **Local access roadway, local roadway:** A roadway designed with the primary function of providing access to an adjacent site or development; a roadway that connects local points but does not accommodate through traffic.

3.4.2.2 Environmental Setting

Patterns of Site Access

As discussed in Section 3.4.1, *Recreation and Visitor Experience*, Muir Beach users include local residents, guests of Green Gulch Farm and the Pelican Inn, visitors from other parts of the greater Bay Area, and out-of-area tourists. Overall, an estimated 70% of usage at Muir Beach is by Bay Area residents, including residents of the local community, for whom the beach and trails are an important resource (Philip Williams & Associates et al. 2003). Consistent with

this breakdown, visitor surveys suggest that more than half of the site's users are returnees, and many users report repeated visits to the site (Manning and Budruk 2003). However, because of the site's proximity to other well-known tourist draws, it is also heavily used by interstate and international tourists (Philip Williams & Associates et al. 2003). Some of these users may also visit the site more than once.

Most (93%) visitors access the site by vehicle (car, truck, van, or SUV). A small percentage arrive on foot (4%), by bicycle (1%), or by other means (Manning and Budruk 2003), including equestrian access.

Roadway Network and Vehicle Access to Muir Beach

Regional access to the Muir Beach Area is provided by US-101, Interstate 580 (I-580; the Richmond–San Rafael Bridge), Hwy 1 (also known as Shoreline Highway), and several local roadways. The regional roadway network is shown on Figure 3.4.1-1. Both US-101 and I-580 are freeways that ultimately connect to Hwy 1 at Tam Junction, east of the project site. Hwy 1, a two-lane, proceeds west over a hill to Muir Beach. Hwy 1 passes Panoramic Highway, a two-lane highway that provides access to Muir Woods, at the top of the hill. From Muir Woods, which is often visited in the same day as Muir Beach (see related discussion in Section 4.2.1, *Recreation and Visitor Experience*), the most direct route to Muir Beach is via the Muir Woods Road, a two-lane highway that connects with Hwy 1 immediately north of Muir Beach. Hwy 1, Panoramic Highway, and Muir Woods Road are winding roadways with narrow shoulders, limited visibility, and restricted passing opportunities.

The section of Hwy 1 that approaches Pacific Way is straight, and therefore is known to have fast-moving traffic. Pacific Way provides the only public vehicle access to Muir Beach from Hwy 1. Pacific Way is a narrow, winding two-lane local access roadway, with a one-lane bridge that crosses Redwood Creek. The road passes the existing Muir Beach parking lot and proceeds uphill to terminate in the residential community adjacent to Muir Beach. Congestion along Pacific Way has been identified as a concern, particularly during peak use periods; the maximum arrival rate documented by recent studies of visitor use patterns was 122 vehicles per hour, which represents a traffic volume in excess of the roadway's capacity. Accessibility along Pacific Way is also vulnerable to flooding between Hwy 1 and the existing bridge, which either makes the road impassible or forces vehicles to slow down as they ford submerged portions of the roadway, worsening the effects of congestion. Heavy traffic on Pacific Way in turn causes delays at the Pacific Way–Hwy 1 intersection (Philip Williams & Associates et al. 2003). In addition, because the existing Pacific Way Bridge can accommodate travel in only one direction at a time, ~~it is unsafe, and~~ at times it is frustrating for drivers who are forced to wait during peak use periods.

Emergency vehicles access Muir Beach via public roadways, and are also authorized to use the levee roadway for access. The levee road is a single-lane

unsurfaced roadway that is graded to maintain it in driveable condition, and accesses the portions of Muir Beach that are east of Redwood Creek.

Table 3.4.2-2 summarizes the existing LOS at several key intersections in the vicinity of Muir Beach, based on traffic counts performed between 2001 and 2004 (see Appendix F).

Table 3.4.2-2. Approach Delay* and LOS at Key Area Intersections During Weekday Peak Traffic Hours

	Peak Season		Shoulder Season		Off-Peak Season	
Intersection	Delay (seconds)*	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS
Weekday Peak Hours						
Shoreline Highway/Muir Woods Road	16.5	C	13.1	B	12.4	B
Shoreline Highway/Pacific Way	14.8	B	11.5	B	11.0	B
Shoreline Highway/Panoramic Highway	>50	F	>50	F	28.9	D
Weekend Peak Hours						
Shoreline Highway/Muir Woods Road	>50	F	>50	F	24.3	C
Shoreline Highway/Pacific Way	17.9	C	15.2	C	11.3	B
Shoreline Highway/Panoramic Highway	>50	F	>50	F	>50	F

* *Approach delay* is the approximate wait time experienced by each vehicle arriving at an intersection, measured in seconds.

Source: DKS Associates 2006, Appendix F.

3.4.2.3 Pedestrian, Bicycle, and Equestrian Access

Figure 3.4.1-2 shows trail access to the Muir Beach area and Muir Beach itself. As discussed in Section 3.4.1, *Recreation and Visitor Access*, most of the area's regional trails are multi-use routes that serve hikers, equestrians, and mountain bikers, although mountain bike use is restricted or prohibited in some areas, including the Redwood Creek Trail and portions of the Green Gulch Trail (Philip Williams & Associates et al. 2003). These uses are therefore discussed together. However, in addition to the hikers, bikers, and equestrians who access Muir Beach from outside the immediate area via the regional trail system, local residents also walk, bike, and horseback ride to the site. Because of the difficulty of parking at the site, local users may represent an important component of the non-vehicular access population.

Several important Marin Headlands trails provide access to the Muir Beach area, including the Coastal Trail, the Redwood Creek Trail, the Green Gulch Trail, and the Dias Ridge Trail (Figure 3.4.1-2), although only the Green Gulch Trail and southern portion of the Coastal Trail provide a direct connection to the parking lot. It is difficult and potentially dangerous to access the parking lot from the

other regional trails, largely because of discontinuities in the trail system, which force pedestrians and bicyclists onto the shoulders of narrow roadways such as Hwy 1 to move from one trail segment from another (Philip Williams & Associates et al. 2003). Considering the speed at which vehicles travel along Hwy 1, the potential hazard to trail users is increased. In addition, visitors who access the site from the immediate Muir Beach Area may arrive via Pacific Way, which does not provide a separate pedestrian path; pedestrians and bicyclists compete with vehicles for space along this route. This is particularly hazardous where the roadway narrows to cross the bridge.

Once at the Muir Beach facility, visitors access the beach itself from the eastern end of the parking lot, via a pedestrian trail and footbridge across Redwood Creek. An informal route that crossed the tidal lagoon was closed in 2003. The beach can also be accessed from the regional trails to the south (Philip Williams & Associates et al. 2003).

3.4.2.4 Public Transit

Until recently, the Marin County Transit District ran the West Marin Stagecoach, a flag-stop coach service along Hwy 1. South Routes 61 and 61e (Bolinas to Mill Valley) stopped at the corner of Hwy 1 and Pacific Way, near the Pelican Inn. The routes connected with Mill Valley, Tam Junction, and the Marin City Golden Gate Transit transfer point. The routes operated Monday through Friday only. Service along Shoreline Highway was discontinued in April 2007 because of low ridership; the Stagecoach route has been realigned along Panoramic Highway.

3.4.2.5 Parking

Figure 1-3 shows the parking lot at Muir Beach. The existing gravel-surfaced lot has no delineated parking spaces, but offers space to accommodate 175 cars.

Table 3.4.2-3 summarizes current parking demand at Muir Beach, based on studies conducted for the proposed project between 2001 and 2004 (Appendix F).

Table 3.4.2-3. Parking Demand at Muir Beach

	Peak Season		Shoulder Seasons		Off-Peak Season	
	Number of Vehicles	Available Parking (%)	Number of Vehicles	Available Parking (%)	Number of Vehicles	Available Parking (%)
Weekdays	159	91	115	66%	30	17%
Weekends	**201**	115	160	91%	120	69%

Bold = demand exceeds number of available spaces.
Source: DKS Associates 2006, Appendix F.

As Table 3.4.2-3 shows, existing parking capacity at Muir Beach is insufficient to accommodate current demand for parking during the periods of heaviest use (peak season weekends). Thus, on average, parking capacity is exceeded on most weekend days during June through August, or about 25 days out of each year. When parking capacity is exceeded, overflow vehicles often illegally park on the shoulders of Pacific Way, where they worsen congestion and increase the hazard to pedestrians, and on streets in the adjacent residential neighborhood, where they may create a nuisance by impeding resident access. Illegal overflow parking on Hwy 1 also creates congestion and safety hazards (Philip Williams & Associates et al. 2003).

Green Gulch Farm, the Golden Gate Dairy stables, and the Pelican Inn all provide separate parking for their users. The Pelican Inn in particular, which is located at the intersection of Pacific Way and Hwy 1, receives some illegal parking overflow from Muir Beach, creating a nuisance for guests and staff at the Inn (Philip Williams & Associates et al. 2003).

3.4.3 Aesthetics

3.4.3.1 Introduction

The discussion below describes the current visual resources setting in the project area. The purpose of this information is to establish the existing environmental context, or background, against which the reader can then understand the environmental changes caused by the project. The environmental setting information is intended to be directly or indirectly relevant to the subsequent discussion of impacts. For example, the setting identifies groups of people who have views of the project area because the project could change their views and experiences.

Criteria for Visual Assessment

Identification of existing conditions with regard to visual resources entails three steps (based on Federal Highway Administration 1983).

1. Objective identification of the visual features (visual resources) of the landscape.
2. Assessment of the character and quality of those resources relative to overall regional visual character.
3. Identification of the importance to people, or *sensitivity*, of views of visual resources in the landscape.

With an establishment of the baseline (existing) conditions, a proposed project or other change to the landscape can be systematically evaluated for its degree of impact.

Concepts and Terminology

Visual Character

Both natural and artificial landscape features make up the *character* of a view. Character is influenced by geologic, hydrologic, botanical, wildlife, recreational, and urban features. Urban features include those associated with landscape settlement and development, such as roads, utilities, structures, earthworks, and the results of other human activities. The perception of visual character can vary significantly seasonally and even hourly as weather, light, shadow, and the elements that compose the visible landscape change. Form, line, color, and texture are the basic components used to describe visual character and quality for most visual assessments (U.S. Forest Service 1974; Federal Highway Administration 1983). The appearance of the landscape is described in terms of the dominance of each of these components.

Visual Quality

Visual *quality* is evaluated using the well-established approach to visual analysis adopted by the Federal Highway Administration (FHWA), employing the concepts of vividness, intactness, and unity (Jones et al. 1975; Federal Highway Administration 1983), as defined below.

- ***Vividness*** is the visual power or memorability of landscape components as they combine in striking or distinctive visual patterns.
- ***Intactness*** is the visual integrity of the natural and human-built landscape and its freedom from encroaching elements; this factor can be present in well-kept urban and rural landscapes, as well as in natural settings.
- ***Unity*** is the visual coherence and compositional harmony of the landscape considered as a whole; it frequently attests to the careful design of individual components in the artificial landscape.

Visual quality is evaluated based on the relative degree of vividness, intactness, and unity, as modified by its visual sensitivity. High-quality views are highly vivid, relatively intact, and exhibit a high degree of visual unity. Low-quality views lack vividness, are not visually intact, and possess a low degree of visual unity.

Visual Sensitivity and Viewer Response

The measure of the quality of a view must be tempered by the overall *sensitivity* of the viewer. Viewer sensitivity is based on the visibility of resources in the landscape, the proximity of viewers to the visual resource, the elevation of viewers relative to the visual resource, the frequency and duration of viewing, the number of viewers, and the type and expectations of individuals and viewer groups.

The criteria for identifying the importance of views are related in part to the position of the viewer relative to the resource. An area of the landscape that is visible from a particular location (e.g., an overlook) or series of points (e.g., a road or trail) is defined as a *viewshed*. To identify the importance of views of a resource, a viewshed may be broken into distance zones of foreground, middleground, and background. Generally, the closer a resource is to the viewer, the more dominant it is and the greater its importance to the viewer. Although distance zones in viewsheds may vary between different geographic regions or types of terrain, a commonly used set of criteria identifies the *foreground* zone as 0.25–0.5 mile from the viewer, the *middleground* zone as extending from the foreground zone to 3–5 miles from the viewer, and the *background* zone as extending from the middleground zone to infinity (U.S. Forest Service 1974).

Judgments of visual quality and viewer response must be made based in a regional frame of reference (U.S. Soil Conservation Service 1978). The same type of visual resource in different geographic areas could have a different degree of visual quality and sensitivity in each setting. For example, a small hill may be a significant visual element in a flat landscape, but have very little significance in mountainous terrain.

Generally, visual sensitivity is higher for views seen by people who are driving for pleasure; people engaging in recreational activities such as hiking, biking, or camping; and homeowners. Sensitivity tends to be lower for views seen by people driving to and from work or as part of their work (U.S. Forest Service 1974; U.S. Soil Conservation Service 1978; Federal Highway Administration 1983). Commuters and nonrecreational travelers have generally fleeting views and tend to focus on commute traffic and not on surrounding scenery, and therefore they are generally considered to have low visual sensitivity. Residential viewers typically have extended viewing periods and are concerned about changes in the views from their homes; therefore, they generally are considered to have moderate to high visual sensitivity. Viewers using recreation trails and areas, scenic highways, and scenic overlooks are usually assessed as having high visual sensitivity.

3.4.3.2 Environmental Setting

Regional Character

Muir Beach is located in the southwest portion of Marin County on the Pacific Ocean approximately 8 miles northwest of San Francisco. The greater San Francisco Bay region is a complex system of mountain ranges, valleys, and waterways that together create areas that are visually unique. These features not only define the character of the region but also contribute to the overall character of California. Some of these notable areas include the wine country of the Napa and Sonoma Valleys, the distinctive urban center of San Francisco, and the vertical cliffs of the Marin Headlands' Pacific coastline. In addition, the region is characterized by panoramic views from hilltops and ridgelines; rolling hillsides whose grasslands range from green and sprinkled with wildflowers in the spring to brown in the summer, contrasting against stately valley oaks with dark green foliage; and numerous waterways, the larger of which are traversed by vessels ranging from tankers to small sailboats.

A mix of industrial, commercial, residential, agricultural, and public open space uses characterizes the project region; only a subset of these (residential, agricultural, public open space, and limited commercial) are found near the project site. Most industrial, commercial, and residential development is located close to the bay. The region's public open space areas are many; the most notable in the vicinity of the project site is the Golden Gate National Recreation Area, which includes the project site itself, as well as Muir Woods, the Marin Headlands, and the Presidio in San Francisco.

Vicinity Character

The project vicinity is defined as the area within 0.5 mile of the project area. The character of the Big Lagoon project area is influenced by its geographic setting on the Pacific Ocean and its surrounding natural beauty. The northern approach

to the project area is provided by Hwy 1, which approaches the site over the last coastal ridge west of Mill Valley and descends to Muir Beach. Muir Beach is a small but picturesque, crescent-shaped beach on the Pacific Ocean, and forms the southern boundary of the project area. Directly adjacent to the beach is a small tidal lagoon, and behind this is the NPS visitor parking lot and associated picnic area. Redwood Creek flows through the center of the project area and is paralleled by the Levee Road.

Existing vegetation at the project site is largely composed of riparian forest and scrub near the parking lot and near Redwood Creek. The Green Gulch pasture is flanked by the creek and Hwy 1 and is characterized as a seasonal wetland. Wildlife in the area includes monarch butterflies in the pine trees, salmon in Redwood Creek, frogs in the pasture, and fox, birds, deer, and coyotes.

Pacific Way crosses the project site from Hwy 1 and then borders the west side of the project area, where the residential community of Muir Beach is located. To the south and southeast, NPS trails climb up along the bluffs of the Golden Gate National Recreation Area. The signature local business is the Pelican Inn, a Tudor-style lodge and restaurant. Muir Beach Overlook is located approximately 0.2 mile west of Muir Beach. From this location, on a clear day, one can see San Francisco's Ocean Beach to the south, Bolinas and Point Reyes to the north, the top of Mt. Tamalpais to the east, and the Farallone Islands to the west.

Viewer Groups and Viewer Responses

Viewer groups in the vicinity of the action area and their sensitivity to visual changes in the area are characterized below.

Residents

The community of Muir Beach is located immediately adjacent to the Big Lagoon project site. Views of the project area, Pacific Ocean, and Muir Beach vary based on the viewer's location in the community. Some views are limited to the immediate foreground because they are obstructed by the built environment. Residents who reside on Lagoon Drive, Pacific Way, Sunset Way, Cove Lane, Ahab Drive, and Seascape Drive are considered to have high sensitivity to visual changes at the Big Lagoon project site because they likely have the best views of the site.

Recreational Users

Many recreational users of Muir Beach run, jog, walk, hike, or bicycle along the numerous trails in Muir Beach and the surrounding areas, including Golden Gate National Recreation Area, Zen Center-Green Gulch Farm, Muir Woods National Monument, and Mount Tamalpais State Park. Hwy 1 is a popular road biking route. The project area is also a popular place for horseback riding, picnicking, wildlife watching, sightseeing, and even boogie boarding on days when the waves are calm. Many tourists eat or stay at the Pelican Inn.

Viewer sensitivity is high among recreational visitors using Muir Beach because they are likely to value the natural environment highly, appreciate the visual experience, and be sensitive to changes in views.

Roadway Travelers

The entire segment of Hwy 1 in Marin County is an eligible state scenic highway under the Caltrans Scenic Highway Program. Motorists traveling along Hwy 1 include area residents, commuters, and Muir Beach users from the region and beyond. Travelers use roadways at varying speeds; normal highway and roadway speeds differ based on the traveler's familiarity with the route and roadway conditions (e.g., presence/absence of rain and/or traffic). Particular views typically are of short duration, except on straighter stretches where views last slightly longer. Viewers who frequently travel these routes generally possess moderate visual sensitivity to their surroundings.

Viewer sensitivity is low among most roadway travelers anticipated to view the action area. The passing landscape becomes familiar to frequent viewers; further, at standard roadway speeds, views are of short duration and roadway users are fleetingly aware of surrounding traffic, road signs, their immediate surroundings within the automobile, and other visual features. Viewers who travel local routes for their scenic quality generally possess a higher visual sensitivity to their surroundings because they are likely to respond to the natural environment with a high regard and as a holistic visual experience.

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3.4.4 Energy, Public Services, Utilities, and Service Systems

This section discusses the utility and public service providers to the unincorporated Muir Beach community in Marin County. Discussion of *energy* refers to use of electricity in the project area. *Public services* include emergency response and protection by fire and police, maintenance of public facilities, and other governmental services. Discussion of *utilities and service systems* include power and natural gas, communication systems, water treatment and distribution facilities, sewer and septic tank services, and solid waste disposal.

3.4.4.1 Utilities

Electricity for Marin County is provided by the Pacific Gas & Electric Company. Approximately 9 percent of the County's electricity is used in unincorporated areas of the county, including the Muir Beach community (Marin County 2004). Within the project area, electricity is supplied to the approximate 150 residences by overhead power lines. Power poles run along Pacific Way and the levee road (the latter of which runs to a water pump which is no longer used). The lines are jointly owned by the Pacific Gas and Electric Company (PG&E) and AT&T, with PG&E being the primary user.

Telephone service for the majority of Marin County is currently provided by AT&T. A utility box that supports the phone company's infrastructure is located adjacent to Pacific Way. A telephone booth exists in the northwest corner of the Muir Beach parking lot, but its telephone has recently been removed due to infrequent use.

Water service for residences in the Muir Beach community is provided by MBCSD. An MBCSD water line runs along the north side of Pacific Way. MBCSD relies on groundwater pumped from wells located in the Frank Valley, approximately 1 mile upstream of the project site (Marin County 2003). In addition, the project site near the existing flashboard weir structure along the levee road contains an electric hook-up for a former groundwater pump that used to service the Wheelwright Farm and Green Gulch Farm. To reduce demand on upstream resources, no running water is provided by NPS at the Muir Beach visitor parking lot. More information on water supply for the project area can be found in Section 3.1.3, *Water Supply*.

All residences in the project area use septic systems to dispose of wastewater, and the area does not have centralized natural gas or cable service. Portable bathrooms are provided for Muir Beach visitors.

3.4.4.2 Solid Waste

Marin County's solid waste is taken to the Redwood Sanitary Landfill in Novato for disposal. As of June 2001, the landfill had remaining capacity for 12.9 million cubic yards of waste, an estimated disposal capacity through the year 2039 (California Integrated Waste Management Board 2005). A secondary alternative is the Bay Cities Refuse Service in Richmond, CA.

3.4.4.3 Park Maintenance

Maintenance of the extensive GGNRA parklands and facilities in Marin, San Francisco, and San Mateo counties is a major, ongoing task. Structures, historic and non-historic, need basic maintenance and repair; utilities must be kept up; trails, roadways, and parking lots require periodic maintenance and repair. At Muir Beach, vegetation management, maintenance of fences, operation of gates, restroom cleaning, and trash pick-up constitute the majority of tasks needed to maintain park facilities and resources at an acceptable level.

3.4.4.4 Fire

Fire protection for the GGNRA is currently operating under the 1993 Fire Management Plan (National Park Service 1993) and managed by the Office of Fire Management. Major NPS firefighting bases are located at Fort Cronkite and at the Main Post of the Presidio of San Francisco.

Local fire protection is provided by the Muir Beach Volunteer Fire Department (MBVFD), which includes 17 members who are all EMT or first responder trained, including an elected volunteer fire chief, and assistant fire chief. The department has two emergency vehicles, which are compatible for use with County vehicles. All volunteers are certified by the state as emergency fire fighters and are trained in CPR. In addition to Muir Beach and the surrounding community, the department is generally the first emergency responder to the Muir Woods National Monument and half the highway distance from Muir Beach to Stinson Beach in the north and Mill Valley to the east. The Department has an average response time of 5 minutes. Several of the department's volunteers are also qualified in cliff-side rescue. Funding for fire protection services is through the Muir Beach Community Services District (Marin County 2003). The local MBVFD station is housed at Golden Gate Dairy, across Hwy 1 from the project site. Regional fire protection and emergency response is provided by Marin County Fire Department. They maintain a facility on Panoramic Highway, on the Throckmorton ridge of Mount Tamalpais.

Pacific Way provides emergency access to the residential neighborhood. The levee road provides emergency access to the southern side of the project site.

3.4.4.5 Police

Muir Beach is protected by National Park Service Rangers of the San Francisco Field Office and based primarily at Fort Winfield Scott and the Cavalry Stables at the Presidio and at Fort Cronkite in the Marin Headlands. The NPS Protection Rangers are trained for horse, motorcycle, bicycle, and ATV beach patrols. They are trained in law enforcement, search and rescue, and emergency medical services.

Local police protection is also provided by the Marin County Sheriff's Department. Deputies from the substation in Marin City serve the unincorporated communities of southern Marin, from the Golden Gate Bridge to Corte Madera and from the Tiburon Peninsula to Muir Beach. Current staffing at the Marin City substation includes 16 officers, with three on duty at all times, four sergeants, one lieutenant, and three complaint takers.

Exhibit 2: Final Environmental Impact Statement

3.4.5 Human Health and Safety

3.4.5.1 Hazardous Substances

Proper handling and disposal of hazardous substances is dictated by NPS policies (discussed in Chapter 4) and the California Department of Toxic Substances Control (DTSC).

The Marin Hazardous and Solid Waste Joint Powers Authority is the countywide agency responsible for implementing household hazardous waste collection in Marin County. Marin Sanitary Service operates a household hazardous waste collection facility in San Rafael that services all of Marin's jurisdictions, except for the City of Novato (Marin Hazardous and Solid Waste Joint Powers Authority 2005).

Exposure of hazardous substances to people can occur from release or improper handling of contaminated soils or waters. Potential human health effects from exposure to hazardous substances can include respiratory or reproductive problems. According to the DTSC's Cortese List, the project area does not contain sites that were previously contaminated by a release of hazardous substances (California Department of Toxic Substances Control 2005). In addition, since the project area does not have a history of land use involving chemicals, hazardous substances are not expected to be present on-site.

3.4.5.2 Fire

NPS Director's Order 18 requires that each park with vegetation capable of burning prepare a plan to guide a fire management program or FMP (National Park Service 1998). The GGNRA completed a Fire Management Plan (FMP), with a ROD signed in 2006 (National Park Service 2006d). The provision of fire protection services in the project area is described in Section 3.4.4, *Energy, Public Services, Utilities, and Service Systems.*

The principal impacts of fire on public health are burns (less common) and the inhalation of particulate matter generated as smoke from unintended fires. Particulate matter is considered such a significant health hazard that it is one of the six criteria pollutants monitored under the Clean Air Act. (See also the discussion in Section 3.1.4, *Air Quality*.) Particulate matter, found in the air-liquid droplets and small solid particles of minerals and soot, can penetrate deep into the lungs.

Healthy adults are not usually at risk from particulate matter; they may experience runny noses and coughing but these symptoms usually subside as the smoke disperses. People with heart or lung diseases, such as congestive heart disease, chronic obstructive pulmonary disease, emphysema, or asthma, can be at risk. People with these conditions may find it difficult to breathe, or may cough

or feel short of breath. Children and the elderly are generally more susceptible to the harmful effects of smoke (California Air Resources Board 2003).

3.4.5.3 Mosquito Abatement

Vector-borne disease control is administered by NPS in cooperation with U.S. Public Health Service; Centers for Disease Control; California Department of Health Services, Vector-Borne Disease Section; and Marin County Department of Health Services. The Marin-Sonoma Mosquito Abatement District (MSMAD), a member of the MVCAC, works under the direct supervision of the GGNRA to assist in addressing vector-borne disease issues following guidelines stated in NPS 77 and 2001 Management policies. MSMAD maintains a small unit responsible for the prevention, elimination, or control of mosquitoes and other arthropods known to be potential carriers of infectious diseases, or that present a public nuisance (Marin-Sonoma Mosquito Abatement District 2005).

Mosquitoes, fleas, ticks, and anthropods can transport diseases such as viral encephalitis (including West Nile virus), malaria, lyme disease, ehrliciosis, babesiosis, plague, and American typanosomiasis. Together with the California Department of Health Services, local mosquito abatement districts monitor the presence and spread of these diseases through use of sentinel chicken flocks, water samples, and traps.

Seasonal, semi-permanent, and permanent wetlands that remain flooded for periods of 2–3 weeks or longer during late summer and early fall provide optimal conditions for mosquito production. In optimal conditions, mosquitoes can rapidly reproduce within 1 to 2 weeks and many species can produce multiple generations during a season. Mosquitoes commonly found in wetland areas generally prefer to breed in warm stagnant water that is rich in organic matter, or within soil and at the base of vegetation along the edges of drying pools of water. The larvae of some species hide among aquatic vegetation for protection against predators.

Integrated pest management methods are used to control mosquito and anthropod populations. It is far less costly and more effective to control mosquito populations as larvae, before they mature and disperse into the environment. The MSMAD's primary emphasis is on cataloging, reducing and abating larval sources. Adult mosquito control, in the form of ultra-low-volume spray, is used only as a temporary measure in non-sensitive natural areas, or when other methods are not feasible. Any application of adulticides only occurs after GGNRA, U.S. Public Health Service, and the NPS Washington office agree that there is a need for such application. All pesticide application must be approved by the NPS IPM program. MSMAD works closely with NPS to provide any needed information to assist in decision-making. Abatement methods employed by the MSMAD are habitat modification, microbial or bacterial insecticides, growth-regulating hormones, and chemical larvicides. Habitat modification, the preferred control method, involves reducing areas of stagnant of water by

modifying channel networks to allow flow exchange (e.g., daily tidal flows) into potential breeding areas (Marin-Sonoma Mosquito Abatement District 2005).

GGNRA will further inform and educate the public by placing educational materials about avoiding mosquito bites at park kiosks and on its web site.

3.4.5.4 Pesticide Use

Fire management and vegetation management activities conducted by the NPS within the GGNRA use pesticides, on a case-by-case approval basis, to control nonnative plant species within specific management areas. Pesticides are used when other alternatives are not feasible to prevent resprouting of cut tree stumps within nonnative evergreen forests or shrub lands, especially on blue gum eucalyptus, acacias, cotoneaster, and various brooms. Foliar applications are approved in limited scenarios where nonnative vine or shrub species create a dense and dominant component of the site, and have included Cape-ivy and eupatory. These species can form dense thickets of impenetrable vegetation near developments and other critical resources, posing a fire hazard.

All pesticide use is administered through each park's integrated pest management coordinator. All pesticides must be applied by a state-licensed pesticide applicator. All use is reported monthly to the coordinator, the county, and the State of California and yearly to the NPS Washington office.

3.4.5.5 Toxic Substances

A Phase I site investigation for potential toxic substances was conducted at the project site by Geocon Environmental Consultants for Caltrans in 1996. Groundwater and soil samples were collected and analyzed for petroleum hydrocarbons, heavy metals and a suite of volatile organic compounds. Lab results showed no substances that exceeded EPA standards or California Department of Toxic Substances Control standards. Based on the Phase I results, additional investigation was not warranted. Soils are considered suitable for hauling and use in other natural areas.

Exhibit 2: Final Environmental Impact Statement

3.4.6 Land Use, Planning, and Agricultural Resources

The project site is located in unincorporated Marin County. The site is composed of both private property and GGNRA lands. The portion of the project site to the east of the existing levee road is owned by the San Francisco Zen Center, which operates Green Gulch Farm, whereas the project area to the west of the levee road is owned by GGNRA. Private property in the project vicinity includes the Pelican Inn and two homes along Lagoon Drive. Pacific Way itself is owned and maintained by the County. The following sections describe the land uses, including agricultural activities, that surround the project site, most of which are shown on Figure 1-3. Relevant land use and zoning designations are provided in Section 4.3.4.6, *Land Use, Planning, and Agricultural Resources*, which describes the guiding regulations and policies related to land use, planning, and agricultural resources.

3.4.6.1 Muir Beach Community

Established in the 1920s, the Muir Beach Community comprises approximately 150 residences and 300 people. It is located on the hillside west of the project site. It is predominantly surrounded by the GGNRA, but shares a small border with Mount Tamalpais State Park to the east. The community also includes Golden Gate Dairy, Green Gulch Farm, the Banducci Flower Farm, and the Pelican Inn, all of which are discussed in more detail below.

3.4.6.2 Green Gulch Farm

Green Gulch Farm is located to the east of project site in Green Gulch, and extends onto portions of the project site as described both above and below. Green Gulch Farm is a 111-acre property owned and managed by the San Francisco Zen Center. Green Gulch Farm, which is private land located within the GGNRA boundary and is designated as a Special Use Zone in the GGNRA General Management Plan (1980), was established in 1972. Approximately 45 permanent residents live there, where Zen training, meditation practice, and programs are their primary focus. On the site, approximately 10–15 acres are used for agriculture, planted with organic herbs, flowers and vegetables. Also on site, approximately 9 acres are used to pasture approximately 12 horses. A portion of this pasturage is on the project site east of the levee road. Green Gulch Farm also includes a riding arena and small paddocks for temporary horse stabling, both of which are located on the project site.

3.4.6.3 Golden Gate Dairy

Golden Gate Dairy is an NPS historic site located to the north of the project site, across Hwy 1 from the Pelican Inn. A local equestrian group, Ocean Riders, is currently permitted to use the barn and stalls to board horses.. Approximately 11 privately owned horses are boarded at this facility, including several owned by residents of the Muir Beach community. The horses are not permitted to pasture on the adjacent hillsides.. The Muir Beach Volunteer Fire Department uses a building at this site for its headquarters and its fire engine.

3.4.6.4 Pelican Inn

The Pelican Inn is located on the southwest corner of the junction of Pacific Way and Hwy 1. This bed-and-breakfast inn provides seven rooms of lodging and a restaurant.

3.4.7 Noise

3.4.7.1 Noise Terminology

Sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. Noise can be defined as unwanted sound. Sound is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level or energy content (amplitude). In particular, the sound pressure level is the most common descriptor used to characterize the loudness of an ambient sound level. The decibel (dB) scale is used to quantify sound intensity. Because sound pressure can vary enormously within the range of human hearing, this logarithmic loudness scale is used to keep sound intensity numbers at a convenient and manageable level. The human ear is not equally sensitive to all frequencies in the entire spectrum, so noise measurements are weighted more heavily for frequencies to which humans are sensitive in a process called *A-weighting*, written dBA.

Different types of measurements are used to characterize the time-varying nature of sound. These measurements include the equivalent sound level (L_{eq}), the minimum and maximum sound levels (L_{min} and L_{max}), percentile-exceeded sound levels (L_{xx}), the day-night sound level (L_{dn}), and the community noise equivalent level (CNEL). Below are brief definitions of these measurements and other terminology used in this chapter:

- **Sound.** A vibratory disturbance created by a vibrating object, which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone.
- **Noise.** Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- **Ambient Noise.** The composite of noise from all sources near and far in a given environment exclusive of particular noise sources to be measured.
- **Decibel (dB).** A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-pascals.
- **A-Weighted Decibel (dBA).** An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
- **Equivalent Sound Level (L_{eq}).** The average of sound energy occurring over a specified period. In effect, L_{eq} is the steady-state sound level that, in a stated period, would contain the same acoustical energy as the time-varying sound that actually occurs during the same period.
- **Exceedance Sound Level (L_{xx}).** The sound level exceeded XX percent of the time during a sound level measurement period. For example, L_{90} is the sound level exceed 90 percent of the time, and L_{10} is the sound level exceeded 10 percent of the time.

- **Maximum and Minimum Sound Levels (L_{max} and L_{min}).** The maximum or minimum sound level measured during a measurement period.
- **Day-Night Level (L_{dn}).** The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
- **Community Noise Equivalent Level (CNEL).** The energy average of the A-weighted sound levels occurring during a 24-hour period with 5 dB added to the A-weighted sound levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.

L_{dn} and CNEL values rarely differ by more than 1 dB. As a matter of practice, L_{dn} and CNEL values are considered to be equivalent and are treated as such in this assessment.

3.4.7.2 Ambient Noise Environment

Short-term noise monitoring in various parts of the county was conducted for Marin County's Countywide Plan update in 2001. Long term noise monitoring conducted on Hwy 1, north of Stinson Beach, indicates that traffic noise along Hwy 1 is approximately 60 dBA, L_{dn} (Marin County Community Development Agency 2002). Ambient noise levels at Muir Beach and in the adjacent areas are generally low (i.e., at or below 60 dBA, L_{dn}). Primary noise sources in the project area include traffic from the roadways, noise generated by residences and park visitors, and near the beach at the Pacific Ocean.

3.4.7.3 Noise-Sensitive Land Uses

Sensitive land uses are generally defined as locations where people reside or where the presence of noise could adversely affect the use of the land. Typical noise-sensitive land uses include residences, schools, hospitals, and parks. Noise-sensitive land uses the vicinity of the project area include residences located west of the project area, particularly those on Pacific Way and Lagoon Drive that are immediately adjacent to the project area; the Pelican Inn, a bed-and-breakfast lodging that provides a quiet setting for vacationers, located at the corner of Pacific Way and Hwy 1; San Francisco Zen Center's Green Gulch Farm, located to the east of Field 7, which provides a quiet setting for visitors and residents; and recreational users of Muir Beach. Residences and other noise-sensitive land uses also occur along the haul routes to the various fill disposal sites. Figure 1-3 shows the project site and adjacent sensitive receptors.

Chapter 4

Environmental Consequences

4.1 Introduction

This chapter discusses the environmental consequences of the project alternatives. This introductory section introduces the environmental resources that will be analyzed in this chapter and discusses in detail the general methodology used herein to assess the probable environmental consequences, or impacts, of implementing each of the alternatives, and the methods used to assess cumulative impacts.

The environmental resources discussed in this chapter are the same and presented in the same order as in Chapter 3, *Affected Environment*. Each resource section in Chapter 4 presents guiding regulations, the study area, applicable analysis thresholds, and methodology for evaluation of impacts, and identifies the impacts of each alternative on the specific resource areas. The resources discussed are listed below.

- Physical Resources
  - Watershed Processes: Hydrology, Geomorphology, Flooding, Soils and Geology
  - Water Quality
  - Water Supply
  - Air Quality
- Biological Resources
  - Vegetation Communities and Wetlands
  - Wildlife and Wildlife Habitat
  - Fisheries (including special-status species)
- Cultural Resources
- Social Resources
  - Recreation and Visitor Experience
  - Traffic and Circulation

- Aesthetics
- Energy, Public Services, Utilities, and Service Systems
- Human Health and Safety
- Land Use, Planning, and Agricultural Resources
- Noise

General conclusions regarding the impacts of each alternative across resource topics are presented in Chapter 2, Table 2-8.

4.2 Methodology for Assessing Impacts

Potential impacts were assessed for this Final EIS/EIR following the directives of the NPS Director's Order 12 (DO-12; National Park Service 2001a) and the CEQA guidelines to describe impacts in terms of type, duration, timing, context, and intensity.

The type of impact describes the nature of the impact's overall effect on the environment. Impacts are described as either beneficial or adverse.

The duration of impact is the relative length of time the impact would affect a given resource or value, and is generally expressed as short term or long term. Impacts that persist for only 1 year or less are considered short term; impacts that persist over a longer period are generally considered long term. However, in some cases, temporary impacts were considered short-term despite the fact that they would have durations of longer than 1 year. It is important to note that a project that has short-term adverse impacts on a resource may also have long-term beneficial impacts on the same resource.

The timing of impact identifies when the impact would occur. For the purposes of this analysis, the following three time periods are evaluated.

- **Year 0**—This addresses construction-related impacts.
- **Year 5**—This addresses near-term impacts during the early phases of ecosystem establishment following construction.
- **Year 50**—This addresses impacts during the later phases of ecosystem development, within a 50-year planning horizon.

The analyses for Year 5 and Year 50 can be considered bookends; they portray the range of conditions that may be found on the site early in the establishment of the ecosystem and after the ecosystem has matured.

The context of an impact describes whether impacts are site-specific, local, or regional, or, where quantitative standards are available, compares a quantified impact to the standard. In this Final EIS/EIR, the context of the impact is described as individual or cumulative. NEPA Section 1508.7 states that

cumulative impacts can occur in a project area as a result of "individually minor but collectively significant actions taking place over a period of time." A cumulative impact can occur "when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions." Further definitions and the methodology for evaluation of cumulative impacts are provided below under "Methodology for Assessing Cumulative Impacts."

The intensity of an impact describes the degree of the impact on a resource or value. The intensity of each impact is judged as negligible, minor, moderate, or major, as described below. These four designations apply to beneficial as well as adverse impacts.

- **Negligible**—The impact is at the lower level of detection; there would be no measurable change.
- **Minor**—The impact is slight but detectable; there would be a small change.
- **Moderate**—The impact is apparent and appreciable; there would be a noticeable change, but it may be short term or not permanent.
- **Major**—The impact is severe; there would be a highly noticeable, long-term, and/or permanent measurable change.

These are generalized guidelines for intensity analysis; because the definitions of intensity vary by resource, more specific intensity definitions are provided separately for each resource in this document.

To determine impacts, thresholds were established to help assess the severity and magnitude of changes, both adverse and beneficial, that each alternative would have on each resource. Each alternative is compared to a baseline, which is the continuation of current management and site features, or the No Action Alternative referred to herein as Alternative 1. Because the thresholds vary by resource, thresholds are described separately for each resource in this document.

Impacts were identified within the study area specified for each resource. In most cases, the study area was the approximately 40-acre project area and surrounding environs. When the study area differs from the project area, it is described specifically below in the resource-specific methodology section.

4.2.1 Mitigation Measures

Mitigation measures are actions taken to reduce, avoid, or offset identified adverse impacts. All relevant, reasonable mitigation measures that could improve the project are identified. For the purposes of CEQA, all adverse impacts that are characterized as major are considered significant and require mitigation. Moderate adverse impacts may be considered significant depending upon context, intensity, and duration. Minor adverse impacts are considered less than significant and do not trigger the need for mitigation under CEQA.

In some cases, mitigation to reduce adverse impacts below the level of significant may not be available or feasible; under CEQA, adverse impacts that remain significant after implementation of all feasible mitigation measures are considered significant and unavoidable. In the environmental analysis, the significance level of each impact is identified both with and without mitigation.

4.2.2 Format of Impact Discussion

Due to the complexity of the project, involving a total of 20 alternatives in four categories, or a total of 700 possible combinations, the impact discussions have been organized and summarized in a format that is different from the typical Final EIS/EIR. Within each resource section, separate discussions are provided for each of the project components, i.e., restoration, public access, bridge, and fill disposal. The discussion of each project component consists of a summary table followed by text. An example is given on the next page. The reader will note that the context, duration, and timing of the impact are given in parenthesis following the impact title.

Restoration Alternatives

Table 4.1.1.1-1. Title

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
Impact Number: Impact Title	Negligible/ Negligible	Moderate Beneficial	**Moderate Adverse/** Minor Adverse	**Major Adverse/ Moderate Adverse**	Mitigation Measure: Mitigation Measure Title

Impact Number: Impact Title (Short-Term or Long-Term, Years 0, 5 and/or 50)

General discussion of impact mechanism.

Restoration Alternative 1: Negligible. Discussion of how impact applies to this alternative. Significance conclusion, identification of mitigation measures if applicable, and significance level following mitigation. In this example, because impacts are negligible, no mitigation is required.

Restoration Alternative 2: Moderate Beneficial. Same as above. In this example, because impacts are beneficial, no mitigation is required.

Restoration Alternative 3: Moderate Adverse. Same as above. Because impacts are significant (denoted in bold in the table above), mitigation is required. In this example, impacts after mitigation are less than significant (denoted as not bold in the table above).

Restoration Alternative 2: Major Adverse. Same as above. Because impacts are significant (denoted in bold in the table above), mitigation is required. In this example, impacts after mitigation are still significant (denoted as bold in the table above). This would be a significant and unavoidable impact.

4.2.3 Conclusions Regarding Resource Impairment

The NPS Organic Act of 1916 (16 USC l 2 3, and 4) and the NPS General Authorities Act of 1970, as amended (90 Stat. 1940, 16 USC 1–5), require park managers to ensure that park resources and park values remain unimpaired. DO-12 defines *impairment* in the following way.

> … an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values.
>
> An impact to any park resource or value may constitute an impairment. An impact would be more likely to constitute an impairment to the extent that it affects a resource or value whose conservation is:
>
> - Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park; Key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or Identified as a goal in the park's general management plan or other relevant NPS planning documents.
> - An impact would be less likely to constitute an impairment to the extent that it is an unavoidable result, which cannot reasonably be further mitigated, of an action necessary to preserve or restore the integrity of park resources or values.
> - Impairment may occur from visitor activities; NPS activities in the course of managing a park; or activities undertaken by concessionaires, contractors, and others operating in the park.

Individual conclusions regarding resource impairment are provided for each alternative in Chapter 2, Table 2-8.

4.3 Environmental Impact Analysis - Direct, Indirect, and Cumulative Impacts

4.3.1 Physical Resources

4.3.1.1 Watershed Processes

This section discusses potential impacts of proposed project alternatives with respect to the following watershed processes: hydrology, flooding, geology/soils/geohazards, and geomorphology.

Guiding Regulations and Policies

Hydrology and Stream Channel Morphology

NPS Management Policies 2006 (2006a) states:

> The Service will manage watersheds as complete hydrologic systems and minimize human caused disturbance to the natural upland processes that deliver water, sediment, and woody debris to streams. These processes include runoff, erosion, and disturbance to vegetation and soil caused by fire, insects, meteorological events, and mass movements. The Service will manage streams to protect stream processes that create habitat features such as floodplains, riparian systems, woody debris accumulations, terraces, gravel bars, riffles, and pools. Stream processes include flooding, stream migration, and associated erosion and deposition. The Service will protect watershed and stream features primarily by avoiding impacts to watershed and riparian vegetation and by allowing natural fluvial processes to proceed unimpeded. When conflicts between infrastructure (such as bridges and pipeline crossings) and stream processes are unavoidable, NPS managers will first consider relocating or redesigning facilities, rather than manipulating streams. Where stream manipulation is unavoidable, managers will use techniques that are visually non-obtrusive and that protect natural processes to the greatest extent practicable.

Flooding

Congress, alarmed by increasing costs of disaster relief, passed the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. The intent of these acts is to reduce the need for large publicly funded flood control structures and disaster relief by restricting development in floodplains.

FEMA administers the National Flood Insurance Program to provide subsidized flood insurance to communities that comply with FEMA regulations limiting development in floodplains. FEMA issues flood insurance rate maps (FIRMs) for communities participating in the National Flood Insurance Program (NFIP). These maps delineate flood hazard zones in the community. FEMA-designated floodplains are presented in Figure 3.1.1-5.

Executive Order 11988 (Floodplain Management) addresses floodplain issues related to public safety, conservation, and economics. It generally requires federal agencies constructing, funding, or permitting projects in a floodplain to:

- Avoid incompatible floodplain development,
- Be consistent with the standards and criteria of the NFIP, and
- Restore and preserve natural and beneficial floodplain values.

Soils

Soil resources are subject to the NPS Management Policy "no impairment" clause, which guides NPS decision making to protect the integrity of the important resources and values within the parks (National Park Service 2000, §1.4.6). NPS is directed to protect geologic features from the adverse effects of human activity, while allowing natural processes to continue (National Park Service 2000, §4.1.5 and §4.8.2). Management action taken by the parks would prevent, to the greatest extent possible, unnatural erosion, physical removal, contamination, and other potentially irreversible impacts to soil (National Park Service 2000, §4.8.2.4).

Hydric soils, which are associated with wetland features such as bogs, marshes, and some wetlands, are afforded special protection by Executive Order 11990, Protection of Wetlands, and Clean Water Act Section 404 as regulated by USACE and the SWRCB. Specific procedural guidance to NPS staff on the protection of wetlands and areas of hydric soils is outlined in NPS Director's Order 77-1, Wetland Protection. Assessment of potential impacts to hydric soils and wetlands is addressed below in the *Vegetation Communities and Wetlands* section of this chapter.

Geohazards

California's Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) (PRC §§2621 et seq.), originally enacted in 1972 as the Alquist-Priolo Special Studies Zones Act and renamed in 1994, is intended to reduce the risk to life and property from surface fault rupture during earthquakes. The Alquist-Priolo Act prohibits the location of most types of structures intended for human occupancy across the traces of active faults and strictly regulates construction in the corridors along known active faults (earthquake fault zones). It also defines criteria for identifying active faults, giving legal weight to terms such as *active*, and establishes a process for reviewing building proposals in and adjacent to earthquake fault zones.

Like the Alquist-Priolo Act, the Seismic Hazards Mapping Act of 1990 (PRC §§2690–2699.6) is intended to reduce damage resulting from earthquakes. While the Alquist-Priolo Act addresses surface fault rupture, the Seismic Hazards Mapping Act addresses other earthquake-related hazards, including strong groundshaking, liquefaction, and seismically induced landslides. Its provisions are similar in concept to those of the Alquist-Priolo Act: the California Geological Survey is charged with identifying and mapping areas at risk of strong groundshaking, liquefaction, landslides, and other corollary hazards, and

cities and counties are required to regulate development within mapped Seismic Hazard Zones.

The State of California's minimum standards for structural design and construction are given in the California Building Standards Code (CBSC) (CCR Title 24). The CBSC is based on the Uniform Building Code (UBC) (International Conference of Building Officials 1997), which is used widely throughout United States (generally adopted on a state-by-state or district-by-district basis), and has been modified for California conditions with numerous, more detailed and/or more stringent regulations.

The CBSC requires that

> ...classification of the soil at each building site … be determined when required by the building official" and that "the classification … be based on observation and any necessary test of the materials disclosed by borings or excavations." In addition, the CBSC states that "the soil classification and design-bearing capacity shall be shown on the (building) plans, unless the foundation conforms to specified requirements.

The CBSC provides standards for various aspects of construction, including but not limited to excavation, grading, and earthwork construction; fill placement and embankment construction; construction on expansive soils; foundation investigations; and liquefaction potential and soil strength loss. In accordance with California law, project design and construction will be required to comply with provisions of the CBSC.

Study Area

The study area for consideration of watershed processes is the Redwood Creek watershed and the coastal environment in the vicinity of the mouth of Redwood Creek, with particular focus given to the project site.

Analysis Thresholds

Low-Flow Hydrology

These significance thresholds describe impacts related to the dry season (summer and early fall), when low-flow conditions are generally present in Redwood Creek.

- **Negligible:** Alternative would result in no measurable changes to surface flows.
- **Minor:** Alternative would result in small change in surface flows, with the anticipated frequency of channel drying changed by 0 to 10%.
- **Moderate:** Alternative would result in change in surface flows, with the anticipated frequency of channel drying changed by 10 to 50%.

- **Major:** Alternative would result in change in surface flows, with the anticipated frequency of channel drying changed by 50% or greater.

Flooding of Structures or Infrastructure

- **Negligible:** Alternative would result in no measurable changes to the risk of injury, death, or property damage as a result of flooding.
- **Minor:** Alternative would result in small change in risk of injury, death, or property damage as a result of flooding. In the case of adverse impacts, evacuation of people would be slightly more difficult than under existing conditions or the increase in flood risk to structures would be minor, with a possibility of slight damage to property. In the case of beneficial impacts, risk of injury, death, or property damage would be reduced slightly and would be associated with increased ease of evacuation or a small decrease in the exposure of structures to flood risk.
- **Moderate:** Alternative would result in a moderate change in risk of injury, death, or property damage as a result of flooding. In the case of adverse impacts, evacuation of people would be substantially more difficult or the increase in flood risk to structures would be considerable, with a possibility of appreciable damage to property. In the case of beneficial impacts, risk of injury, death, or property damage would be reduced and would be associated with increased ease of evacuation, reduction of flood risk such that some structures would no longer be within the existing 100-year floodplain, or a moderate decrease in the potential for property damage.
- **Major:** Alternative would result in a substantial change in risk of injury, death, or property damage as a result of flooding. In the case of adverse impacts, evacuation of people would not be possible, and the increase in flood risk to structures in the floodplain would be severe, with a likelihood of extensive damage to property. In the case of beneficial impacts, risk of injury, death, or property damage would be greatly reduced and would be associated with elimination of the need for evacuation, reduction of flood risk such that many structures would no longer be within the existing 100-year floodplain, and/or a large decrease in the potential for property damage.

Soils

- **Negligible:** Alternative would not result in measurable change in soil function, soil erosion, or loss of topsoil.
- **Minor:** Alternative would result in changes in soil function, amount of erosion, or loss of topsoil over an area of up to 5 acres. Impacts to soils would be temporary.
- **Moderate:** Alternative would result in changes in soil function, amount of erosion, or loss of topsoil over an area of 5–10 acres. Impacts to soil function would be experienced throughout the lifetime of the project.
- **Major:** Alternative would result in changes in soil function, amount of erosion, or loss of topsoil over an area of greater than 10 acres. Impacts to soils extend beyond the project lifetime or would be permanent.

Geohazards

- **Negligible:** Alternative would result in no measurable changes to the risk of injury, death, or property damage as a result of landslide; construction on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse; or rupture of a known earthquake fault, strong seismic groundshaking, or seismic-related ground failure, including liquefaction.
- **Minor:** Alternative would result in small change in risk of injury, death, or property damage as a result of landslide; construction on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse; or rupture of a known earthquake fault, strong seismic groundshaking, or seismic-related ground failure, including liquefaction.
- **Moderate:** Alternative would result in an appreciable change in risk of injury, death, or property damage as a result of landslide; construction on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse; or rupture of a known earthquake fault, strong seismic groundshaking, or seismic-related ground failure, including liquefaction.
- **Major:** Alternative would result in a substantial, highly noticeable change in risk of injury, death, or property damage as a result of landslide; construction on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse; or rupture of a known earthquake fault, strong seismic groundshaking, or seismic-related ground failure, including liquefaction.

Geomorphology

- **Negligible:** Alternative would result in no measurable changes to the ability of the stream channel to pass or otherwise accommodate sediment loads and maintain equilibrium channel form.
- **Minor:** Alternative would result in small change to the ability of the stream channel to pass or otherwise accommodate sediment loads and maintain equilibrium channel form. Although the stream channel morphology may change over time, the need for maintenance activities to maintain channel form or conveyance capacity within the project lifetime would not be changed, and the risk of channel avulsion or incision would remain the same, or, if changed, would not substantially change ability to transport or accommodate sediment loads.
- **Moderate:** Alternative would result in moderate change to the ability of the stream channel to pass or otherwise accommodate sediment loads and maintain equilibrium channel form. The potential to need channel maintenance to maintain channel form or conveyance capacity within the project lifetime would be changed. In the case of adverse impacts, the risk of

channel avulsion or incision would be slightly increased or the ability to transport or accommodate sediment over time could decrease. In the case of beneficial impacts, the alternative would result in a moderate increase in the ability to accommodate or pass sediment. The risk of channel avulsion or incision would be slightly decreased, or, if unchanged, would not result in measurably decreased sediment transport capacity.

- **Major:** Alternative would result in a large change to the ability of the stream channel to pass or otherwise accommodate sediment loads and maintain equilibrium channel form. The potential to need channel maintenance to maintain channel form or conveyance capacity within the project lifetime would be substantially changed. In the case of adverse impacts, the risk of channel avulsion or incision would be greatly increased or the ability to transport or accommodate sediment over time would likely decrease. In the case of beneficial impacts, the alternative would result in a large increase in the ability to accommodate or pass sediment, or the risk of channel avulsion or incision would be greatly decreased.

Methods and Assumptions

The following impact topics were dismissed from further consideration in the Final EIS/EIR for the reasons stated.

- **Risk of Tsunami.** Although the project is located close to the Pacific Ocean, it is not anticipated to substantially alter the number of visitors to Muir Beach or number/value of structures in the inundation area, and therefore should not substantially alter the exposure to risk of tsunami.
- **Mineral Extraction.** The project is not located in an area of existing or planned mineral extraction.
- **Geologic Features and Processes.** Because the site consists primarily of artificial fill and estuarine deposits, no important geologic features are present in the project site that would be adversely affected by excavation and earthwork; once completed, the alternatives are anticipated to have either a negligible or beneficial effect to natural geologic processes in this area by restoring more natural hydrologic patterns, and hence patterns of alluvial deposition.

Evaluation of other impact topics was completed as described below for each topic.

Low-Flow Hydrology

Low-flow hydrology (i.e., flow characteristics of Redwood Creek during the dry season or drought conditions) was evaluated through two methods: a water balance for each alternative was compared to existing conditions, and an evaluation of the anticipated groundwater elevations relative to the channel thalweg and/or lagoon bottom elevations was conducted.

- **Water Balance.** A water balance was completed for each alternative that estimated inflows, and evaporation and evapotranspiration (ETo) losses, as described in Philip Williams & Associates et al. (2004). Evaporative losses were based on the extent of open water under each alternative, and ETo losses were based on the vegetated acreage, assuming that wetland and riparian plants consume about 35 inches per year (Philip Williams & Associates et al. 1994). Where evaporation and ETo losses exceeded inflows, water elevations would be lowered. Where such lowering of the water surface elevation would result in water levels below the channel thalweg elevation, streamflows would essentially be subsurface and recharge the aquifer, and dry channel conditions would exist. The relative frequency of lowered water elevations and dry channel conditions was then qualitatively compared to existing conditions.

- **Groundwater and Channel Elevations.** The potential for reduced flows or dry channel conditions as a result of lowered groundwater elevations was evaluated using channel thalweg data for the various alternatives.

  During low-flow conditions, groundwater levels are set by tidal influence and thalweg elevations in the lower portion of the project site near the ocean. Therefore, thalweg elevations in the lower portion of the project site, together with mean high tide elevations, were compared to thalweg elevations in the upper reaches of the project site to determine the potential for reduced flows or dry channel conditions. Where groundwater elevations are expected to be below the channel thalweg elevation, streamflow would percolate downward to recharge the aquifer, and dry channel conditions would exist. During moderate- to high-flow conditions, the aquifer is fully recharged, Redwood Creek is not a “losing” stream, and, therefore, groundwater levels would not generally affect flows. The methods and results are discussed in detail in Philip Williams & Associates (2004).

  In addition, for Alternatives 3 and 4, the local effect of the lagoons on groundwater levels, and the resulting effect to channel flows considering channel thalweg elevations relative to water levels in the vicinity of the lagoons, were also considered. In other words, where the surface water elevation in the lagoons is lower than the thalweg of the nearby channel, the channel would be expected to be dry as flows percolate toward the lagoons.

Flooding of Structures and Infrastructure

The potential for flooding of buildings in the vicinity of Pacific Way and Hwy 1, and on Pacific Way itself, was analyzed using the predicted water surface elevations produced by a hydraulic model originally developed and presented in the Feasibility Analysis Report (Philip Williams & Associates et al. 2004) using the Danish Hydraulic Institute’s MIKE-11 software package. MIKE-11 is a comprehensive, one-dimensional modeling system for the simulation of flows, based on the complete partial differential equations of open channel flow. The equations are solved by implicit, finite difference techniques. The formulations can be applied to branched and looped networks and quasi two-dimensional flow simulations on floodplains. MIKE-11 operates on the basis of information about the creek and the floodplain topography, including constructed structures such as bridges, embankments, weirs, gates, and dredging schemes. This methods section

is intended to give an overview of the modeling approach; for a complete description please refer to Philip Williams & Associates et al. (2004) and Appendices D and E.

Model Iteration 1, Uncalibrated Model. In the first iteration of modeling, the MIKE-11 model assumed a main branch, various out-of-bank flow paths, and linkages connecting the out-of-bank flow paths to the main branch. Flows were routed through 19 topographic channel cross sections in the study area. The upstream boundary input consisted of the estimated Redwood Creek discharge at the Hwy 1 bridge for the given flow recurrence event (i.e., Q5 or Q50; refer to Figure 3.1.1-4 and Table 3.1.3-3). The model was not calibrated. The downstream boundary was the Pacific Ocean, with a constant water level set at mean higher high water. This represents a reasonable worst-case scenario with respect to backwater effects from the ocean. Roughness values of the channel and floodplain were estimated based on channel substrate and floodplain vegetation. In general, the roughness in the main channel was specified with a Manning's *n* (*n*) value of 0.05 in the upper reaches and an *n* value of 0.03 through the sandier reach surrounded by sand dunes. The out-of-bank areas have an *n* value of 0.07 to 0.10 depending on the relative amount of roughness and expected flow depth.

The model did not include flows from the two Green Gulch tributaries, for two reasons: the hydrology of these tributaries is not well defined, and limited information on the hydrology of these tributaries suggests that they are not significant relative to overall flows on Redwood Creek. The model assumed that the new bridge would be designed such that it did not present a hydraulic impediment to flood flows, and that 90 feet had been removed from the lower end of the existing parking lot. Modeling was conducted using the Q5 and Q50 events for the Restoration Alternatives 1, 2, and 4 at Year 0 and Year 50. For the modeling of Year 50 conditions, sea level rise of 0.7 foot was assumed (see Section 3.1.1, *Watershed Processes*, for a more complete discussion of sea level rise under "Ocean and Beach Characteristics"). Year 50 channel cross sections were estimated based on the 50-year site configurations as presented in the figures in Chapter 2. The effects related to Restoration Alternative 3 were interpolated based on the results of Restoration Alternatives 2 and 4.

This iteration of modeling is the only one that modeled the alternatives at Year 50. For this reason, the results of this iteration of modeling have been used to evaluate the change in flooding conditions over time as the site evolves. Although the model was not calibrated at this point, the Year 0 and Year 50 conditions are useful for comparative purposes.

Model Iteration 2, Calibrated Model. A second iteration of modeling was completed for use in the Final EIS/EIR (Appendix E). Roughness values were updated for various reaches, branches, and floodplains for the modeled alternatives. Low-roughness areas included the portion of the channel dredged during the 2002 flood reduction measures, and high-roughness areas included the vegetated portions of the floodplain and the willow-choked zone near the parking lot. Channel cross sections and flow paths were also updated to reflect new

topographic survey data, and the modeling of Restoration Alternatives 2 and 4 included a new 200-foot bridge with a soffit elevation of 16.5 feet NGVD.

The model was then calibrated based on data collected during storm events in December 2004 and January 2005, including measured flow rates and daily stage data at the Hwy 1 bridge, as well as peak water surface elevations at several points in the project site. Calibration was completed by adjusting roughness values for different parts of the channel and floodplain. For existing conditions, the roughness in the main channel ranged from *n* 0.03 in sandy areas to 0.08 in areas with dense vegetation. The majority of the channel had *n* values of around 0.045. For both Alternatives 2 and 4, the roughness in the main channel ranged from *n* 0.03 in sandy areas to 0.09 in areas anticipated to have high concentrations of large woody debris. A typical *n* value that characterized the rest of the main channel after restoration was 0.06. Alternative 4 had a roughness *n* value of 0.03 in the large lagoon, with *n* values of approximately 0.09 for the wetland vegetation surrounding the lagoon. The out-of-bank and floodplain areas had *n* values of 0.10 and 0.12 depending on the relative amount of roughness and the expected flow depth.

Following calibration, the existing conditions model was run for five storm events, and model results were compared to observed conditions at the three stations where water surface elevations were measured. Once calibrated, the modeled results of water surface elevation, on average, were within 0.13 foot of the measured results, with a maximum difference of 0.39 foot.

The model was then run for Restoration Alternatives 1, 2, and 4 at Year 0 for the Q5, Q50, and Q100 storm events. Predicted surface elevations for these storm events were plotted against the locations/elevations of structures at risk from flooding and other site features. As under Model Iteration #1 above, the effects related to Restoration Alternative 3 were interpolated based on the results of Restoration Alternatives 2 and 4.

The results of this iteration of modeling have been used in this Final EIS/EIR to identify the relative differences between the effects of the Restoration Alternatives at Year 0. Although subsequent modifications to alternative design were later completed, the modeling completed in this iteration still provides useful comparative information between the alternatives.

Model Iteration 3, Bridge Sensitive Analysis. Finally, a sensitivity analysis was performed using different bridge lengths to identify the potential effects of the new bridge (Appendix D). For this analysis, modeling consisted of simulating Restoration Alternative 1 with the existing bridge, and Restoration Alternative 2 with various bridge designs. The model was refined using new topographic survey data collected in August 2005, and two new cross sections were added to the model. The longitudinal profile along the left bank of the existing channel was incorporated in the model to better characterize the link between the main channel and the floodplain. Floodplain and roughness values for the design conditions were refined to simulate conditions after vegetation had established

(approximately Year 5 conditions). In other words, similar roughness values were used for existing and design conditions.

In general, channel roughness was assumed to be *n* 0.06 based on previous model calibration. The Green Gulch pasture was given a higher roughness value (*n* = 0.09) based on the assumption that there would be more LWD in the channel for complexity, habitat enhancement, etc. Less LWD was assumed to be placed and maintained in the upstream reach (*n* = 0.06) due to the proximity of private property and the Pacific Way road. For channel and bank areas immediately underneath the bridge, a roughness *n* value of 0.035 was used. For floodplain and out-of-bank areas underneath longer-spanning bridges, the assumed roughness *n* value was 0.045, assuming that the 36 foot–wide bridge would shade out most vegetation.

Floodplain roughness was assumed to vary with water depth. The selected roughness was *n* 0.20 for flows up to 4 feet water deep. Above this water depth, the roughness was decreased to *n* 0.12 to represent the lower resistance from floodplain vegetation. A roughness coefficient of 0.03 was used for Pacific Way road and its embankment.

In addition, the existing conditions model assumed that a Q100 event would deliver a large volume of sediment, consistent with observed channel aggradation patterns. To simulate this, it was assumed that the channel directly beneath and upstream of the Pacific Way Bridge would be filled to pre-2002 channel elevations during such a storm event. For design conditions, the dimensions of the new channel were adjusted to better match field measurements of the restored channel on the Banducci site. In addition, the dimensions of the new channel downstream of the Pacific Way Bridge were adjusted to reflect a wider and shallower channel design to allow more frequent out-of-bank flow and floodplain inundation. Finally, the model assumed that 1) a portion of the existing channel upstream of Pacific Way would not be filled in and remain a backwater channel and 2) less LWD would be placed in the reach upstream of Pacific Way to reduce the potential flooding of private property and Pacific Way.

For the model, the new bridge was assumed to have a 2 foot–thick deck and be 36 feet wide. Bridges up to 50 feet long were modeled without piers, and longer bridges were modeled with 2 foot–wide piers spaced at 40-foot intervals along the length of the bridge. Bridge submergence and overflow were allowed to occur in the model. Bridges longer than 50 feet were modeled as three separate but connected bridge components spanning the right floodplain, channel, and left floodplain, to show how flows would be distributed across the floodplain. Raised roadway approaches to the bridge assumed 3:1 side slopes. <u>While bridge designs for Bridge Alternative BR4 call for a narrower bridge and a reduced length, these changes do not affect the fundamental conclusions of the modeling effort. For this reason, the model was not updated in the Final EIS/EIR.</u>

The results of this iteration of modeling have been used in this Final EIS/EIR to identify the relative differences between various Bridge Alternatives at Year 0. Because the modeling of the new bridge was conducted assuming the use of

Restoration Alternative 2, the combined effects of various Bridge Alternatives with Restoration Alternatives 3 and 4 should be considered using the comparisons drawn out between the Restoration Alternatives in Model Iteration 2 above.

In addition, this round of modeling has the best representation of the Preferred Alternative, which combines Restoration Alternative 2 with Bridge Alternative BR3.

Effects of the Parking Lot. Sensitivity analyses for various parking lot setbacks were performed as part of the modeling performed under Model Iteration 2 (Philip Williams & Associates et al. 2004). These conclusions are used in this Final EIS/EIR to estimate the effects of the various parking lots. Floodplain storage is also considered based on the footprint of the lot.

Interpretation of Model Results. The modeling conducted for this Final EIS/EIR has been used to draw comparisons between various scenarios. While the modeled results may approximate “real world” conditions, an evaluation of model accuracy is difficult, especially for hypothetical situations (i.e., the action alternatives). This is true for all hydraulic models, not just MIKE-11, and the MIKE-11 model has been subject to extensive model verification, such that it is thought to provide a very good representation of field conditions. For this reason, the reader is cautioned to interpret the MIKE-11 model results as a basis to make relative comparisons between alternatives, rather than to make absolute conclusions.

For instance, a strong conclusion as to whether the Pelican Inn parking lot would flood under Restoration Alterative 2 in a Q5 storm event is not advisable; however, a conclusion regarding the extent to which water surface elevations would be higher or lower in this scenario relative to Restoration Alternative 1, is a reasonable inference to make from the model.

In addition, although modeling assumed that sediment would gradually accumulate at the site over the long term, episodic events in the watershed (e.g., large storms, earthquake, fire) could deliver large amounts of sediment to the site, or other changes in site morphology (e.g., channel avulsion, debris blockages) could alter flooding at the site in ways that are difficult to predict.

Table 4.3.1.1-1 shows which model iterations were used to analyze impacts in the Final EIS/EIR.

Table 4.3.1.1-1. Model Runs Used for Analysis in the Final EIS/EIR

Impact Topic	Philip Williams & Associates et al. 2004	Appendix E	Appendix D
Restoration Alternatives, Year 0		X	
Restoration Alternatives, Year 50	X		
Parking Lot Alternatives	X		
Bridge Alternatives			X
Preferred Alternative			X

Soils

Effects on soils were evaluated qualitatively, considering the extent of soil disturbance and potential for erosion associated with construction, as well as considering the potential for the alternatives to affect soil processes and soil formation over the long term, primarily associated with anticipated patterns of alluvial deposition of soil material based on the hydrologic characteristics of each alternative. Soil profiles are anticipated to be somewhat artificial because of disturbance and deposits of artificial fill through the 19th and 20th centuries; for this reason, this discussion focuses more on soil function than the soil profile, which can take many hundreds of years to develop. Soil function in this context refers to the presence of soil biota, nutrient cycling, and hydrologic function.

Geohazards

Impacts related to seismicity and other geologic hazards were analyzed qualitatively, based on a review of soil and geologic data for the project site and a site reconnaissance. Analysis focused on each alternative's potential to alter the risk of personal injury, loss of life, and damage to property, including project facilities, as a result of existing conditions in the study area.

The following key sources were used in the analysis.

- ABAG's hazard mapping website (http://www.abag.ca.gov)
- Map showing principal debris-flow source areas in the San Francisco Bay region (Ellen et al. 1997).
- Map showing slides and earth flows in the San Francisco Bay region (Wentworth et al. 1997).
- Geologic map of Marin County (Blake et al. 2000).
- State of California guidelines for the evaluation and mitigation of seismic hazards in California, including the state's stipulations regarding the conduct of geotechnical investigations (see *Guiding Regulations and Policies* above).

Stream Channel Morphology

Aspects of stream channel morphology related to habitat quality are discussed in Section 4.3.2.1, *Vegetation Communities and Wetlands*, Section 4.3.2.2, *Wildlife*,

and Section 4.3.2.3, *Fisheries*. In this section, each alternative was evaluated for its potential to increase channel incision, aggradation, or avulsion/migration. Each of these factors and the methods for their evaluation are described below.

- **Incision.** Channel incision occurs when the ability of the channel to pass sediment exceeds sediment supply. In these cases, a net deficit of sediment occurs, resulting in channel downcutting.
  - The potential for incision was evaluated based on the channel gradient in the various alternatives, which drives the ability to pass sediment, and sediment supply.
  - Grade controls that would inhibit incision, such as concrete structures in the bed of the channel, channel-spanning weirs, or bedrock, were also considered.
  - The analysis is based on the results of channel stability analysis performed in Philip Williams & Associates (2004), which used the Stable Channel Analytical Model (SAM) developed by USACE. Stable channel dimensions refer to a channel geometry that will pass a prescribed sediment load without deposition or erosion. The SAM methodology is an analytical approach that determines dependent design variables of width, slope, and depth from independent variables of discharge, sediment inflow, and bed material composition.

    The 1.5-year return period discharge (Q1.5) was used to estimate stable channel dimensions because, in the absence of data on channel-forming discharge, this is considered to be the event that shapes channel dimensions. The particle size distribution of bed samples taken at the Pacific Way Bridge was used to define the bed gradation parameter in the SAM model. Sediment inflow was estimated by two methods. SAM uses the Meyer-Peter and Muller (MPM) equation to estimate sediment transport capacity in gravel-bed rivers. Though other analytical solutions such as the Parker model might be better suited to this stream, this is the most appropriate of the options available in SAM. The supply reach channel dimensions were input to the model to estimate the incoming sediment flow to the upstream end of the design reach. SAM estimated sediment concentration at the upstream end of the project site to be approximately 530 mg/L, based on sediment transport capacity in a system that is transport limited rather than supply limited. As an independent check and to compare the model estimates to field measurements, suspended sediment and bedload sampling results were used to estimate the sediment transport in Redwood Creek. Using suspended sediment and bedload rating curves, total sediment discharge during the Q1.5 of 570 cfs was estimated to be 510 mg/L. Results of the two separate estimates of sediment transport capacity and sediment supply were in close agreement, indicating that the model estimates are appropriate to the project reach.

    Note that the values predicted by SAM are analytical estimates, and that in reality there will be a range of relatively stable channel dimensions around the precise mean predicted by the model, with increasing

probability of instability as one moves away from the mean. In order to account for the uncertainty associated with the sediment concentration data and the chosen model, analyses were performed at three sediment concentrations: a mean of 530 mg/L representing the estimated sediment concentration, and secondary runs at 20% above and below this value to capture the approximate variance around this mean, based on observed variance in the Redwood Creek data. This provides a range of uncertainty around the predicted mean channel conditions.

The estimated sediment and flow values were modeled with a range of possible channel configurations of varying width, depth, and slope. For the sediment and flow values described above and a 35 foot–wide proposed channel, SAM predicts an equilibrium slope ranging from 0.36% to 0.41%. According to the model predictions, channels steeper than this range would become progressively more erosion-prone, while channels less steep than this would become progressively more deposition-prone. This suggests that a slope of 0.44% (valley axis) would be close to equilibrium but slightly prone to erode. However, it must be recognized that the channel gradient proposed in the conceptual design is estimated from the valley slope. Under the future design phase, more detailed analysis would design the optimal channel slope and dimensions for ecological function, sediment transport, and geomorphic stability. The final channel will be less steep than the valley axis as a result of channel sinuosity, creating a channel planform similar to that shown in the historic site maps. It will be possible to deliberately lower the channel gradient below equilibrium grade

- **Aggradation.** Channel aggradation is the inverse of channel incision, and occurs when the sediment supply exceeds the ability of the channel to pass sediment. In these cases, the channel has a net increase in sediment, and an increase in channel elevation occurs.

  Similar to the evaluation of incision, the potential for aggradation was evaluated based on the channel gradient in the various alternatives, which drives the ability to pass sediment, and sediment supply. Sources of data included information from Philip Williams & Associates regarding channel slope, the *Sediment Budget for Redwood Creek Watershed, Marin County, California* (Stillwater Sciences 2004), and the SAM analysis described above.

- **Avulsion/Migration.** Channel migration is the gradual change in channel location over time. Channel avulsion is an extreme and sudden form of migration. It can occur when a channel bed becomes sufficiently aggraded, or elevated, that streamflow escapes over the banks to the floodplain and results in a permanent or semipermanent abandonment of the existing channel, with flows either cutting a new channel or resulting in sheet flow. The potential for avulsion is particularly high when the channel elevation is higher than other locations in the floodplain, as flows seeks to find the “low ground.”

  For the purpose of this analysis, the potential for avulsion was evaluated considering the elevation of the channel relative to the floodplain, the potential for the channel to aggrade, and the presence of nearby features to

which the channel could avulse (e.g., backwater channels). Philip Williams & Associates (2004) evaluated the potential for avulsion, and this analysis is based on the conclusions of that report.

While sediment transport modeling was conducted by Philip Williams & Associates (Appendix D), the results of that effort were not conclusive and therefore were not used for the purpose of making conclusions in this Final EIS/EIR.

Restoration Alternatives

Table 4.3.1.1-2 summarizes the potential impacts of Restoration Alternatives to watershed processes in the study area. The Restoration Alternatives are described in Chapter 2.

Table 4.3.1.1-2. Watershed Processes—Restoration Alternative Impacts

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
WP-R1: Changes in Groundwater Levels	Negligible	Negligible	Negligible	Negligible	
WP-R2: Potential for Reduced Flows and Increased Frequency of Dry Periods in Redwood Creek	Minor Adverse	Minor Beneficial	Minor Adverse	Minor Adverse	
WP-R3: Temporary Dewatering Effects	Negligible	Negligible	Negligible	Negligible	
WP-R4: Reductions in Flood Elevations in the Near-Term	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	
WP-R5: Reductions in Flood Elevations Over the Long-Term	**Moderate Adverse**	Negligible	Minor Beneficial	Minor Beneficial	No Action Alternative: no mitigation available
WP-R6: Effects on Site Soils	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
WP-R7: Geohazards	Negligible	Negligible	Negligible	Negligible	
WP-R8: Ability to Accommodate Sediment Loads and Maintain Equilibrium Channel Form During Average Sediment Delivery Conditions	**Moderate Adverse**	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	No Action Alternative: no mitigation available
WP-R9: Ability to Accommodate Sediment Loads and Maintain Equilibrium Channel Form During Episodic Events	**Moderate Adverse**	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	No Action Alternative: no mitigation available
WP-R10: Persistence of Backwater Features and Potential for Channel Avulsion	**Moderate Adverse**	Moderate Beneficial	Moderate Beneficial	Major Beneficial	No Action Alternative: no mitigation available
WP-R11: Potential for Channel Incision	Negligible	Negligible	Negligible	Negligible	
WP-R12: Effects of Sediment Delivery on Nearshore Coastal Habitat, Beach Replenishment, and Dune Formation	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	
WP-R13: Effects on Tidal Lagoon Opening and Closure, and Overall Tidal Lagoon Function	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	
WP-R14: Effects of Sea Level Rise	See other impact discussions				

Impact WP-R1: Changes in Groundwater Levels (Long-Term, Years 5 and 50)

During the wet season, groundwater levels tend to be high and can be near or above the ground surface, leading to areas of ponded water. This condition would not be changed by the restoration actions because high flows entering the site, and the resulting saturated conditions, are the primary drivers for this condition.

Groundwater levels during the dry season are set by tidal influence and channel bed (thalweg) elevations in the lower portion of the project site near the ocean. All of the action alternatives would lower groundwater as a result of the thalweg near the ocean being lowered by approximately 1 foot to its more natural elevation. In addition, the lowering of the channel thalweg upstream, as well as the excavated lagoon bottoms under Alternatives 3 and 4, would also reduce groundwater levels in a zone of influence surrounding these features. The lagoons could also reduce groundwater levels as a result of evaporative losses from open water. However, excavations would not be below mean high water, which is the fundamental control on groundwater levels on the site, and therefore effects on groundwater would ultimately be localized in the vicinity of these features.

The reduction in groundwater levels would be approximately 1 foot under Restoration Alternative 2. Restoration Alternative 4 would have the greatest potential effect on groundwater levels, and analysis conducted by Philip Williams & Associates (2005) indicates that groundwater under a worst-case scenario, including drought conditions, this alternative would be:

- Lowered 1 foot downstream of the large lagoon to the beach;
- Lowered 4 feet (to elevation +3 feet NGVD) at the large lagoon area;
- Lowered 3 feet at the upstream end of the large lagoon, transitioning to 1 foot at the Hwy 1 bridge and upstream (assuming “worst-case” channel incision resulting from the project);
- Lowered 3 feet along Green Gulch Creek and the unnamed tributary in the large lagoon site; and
- Transitioned to zero at existing grade control structures.

Restoration Alternative 3 would have a similar decrease in groundwater levels under a worst-case scenario, but to a lesser extent. Under all alternatives, the zone of influence of water table lowering is expected to be roughly within the project limits.

Periodic maintenance dredging (Restoration Alternative 1) and interim flood reduction measures (Restoration Alternatives 2, 3, and 4) would also have potential to have localized effects on groundwater through reductions in the channel thalweg as a result of dredging, following the mechanisms described above.

Because these effects would be localized on the project site and do not result in adverse effects in and of themselves, they are not considered adverse. The

potential effects on channel drying are discussed below under Impact WP-R2, the effects on water supply wells are discussed in Section 4.3.3, *Water Supply*, and the effects on habitat are discussed in Section 4.4.1, *Vegetation Communities and Wetlands*.

Over the long term, sea level rise would cause groundwater levels to increase to an extent consummate with the extent of sea level rise (assumed to be approximately 0.7 foot over the 50-year project time horizon).

Restoration Alternatives 1, 2, 3, 4: Negligible.

Impact WP-R2: Potential for Reduced Flows and Increased Frequency of Dry Periods in Redwood Creek (Long-Term, Years 5 and 50)

Redwood Creek flows naturally decrease during summer and early fall to below 1 cfs. Under natural conditions, the channel becomes completely dry in 1 out of every 4 years; the pumping at the MSCSD well upstream of the project site is believed to increase this frequency to 1 out of every 3 years.

Under the action alternatives, increased frequency of channel drying would be associated with conditions where groundwater levels are below the Redwood Creek channel thalweg, in which case water flowing in Redwood Creek would percolate to recharge the aquifer. Depending on the degree of percolation relative to flow, this would result in a dry channel.

Evaporation and ETo at the site would change under the various alternatives, depending on the extent of open water and vegetation, respectively. These factors would affect the water balance at the site and could also contribute to altered groundwater levels or surface flows.

Restoration Alternative 1: Minor Adverse. Flows in Redwood Creek would remain similar to existing conditions. Redwood Creek would be dry in late summer or early fall approximately once every 3 years. While sea level rise over time would slightly increase groundwater elevations in the study area, channel aggradation is anticipated to keep pace with or exceed the rate of sea level rise, resulting in similar potential for no-flow conditions. Rates of evaporation and ETo at the site are anticipated to remain similar to existing conditions.

Periodic maintenance dredging activities could result in reduced groundwater levels during the dry season in the vicinity of the dredged channel as a result of a reduced channel thalweg, as was observed following the 2002 maintenance activities. However, this would not fundamentally alter groundwater levels over the entire site (which are ultimately driven by the factors described above under Impact WP-R1) and would reverse as the channel continues to aggrade.

However, ongoing maintenance activities are likely to reduce channel complexity in the areas maintained, resulting in a flat channel with an absence of deep pools, and as such would be more susceptible to drying until the system naturally recovers following such maintenance. This is considered a minor adverse impact.

Restoration Alternative 2: Minor Beneficial. The interim flood reduction measures could reduce groundwater levels to some extent as a result of reduced channel thalweg, as was observed during the 2002 maintenance activities. However, the overall frequency of channel drying is not anticipated to be measurably affected.

Under the restoration, flows entering the site would not be changed by the project and would continue to be dry in approximately once every 3 years. Once on the site, flows would have reduced potential for drying because channel thalweg in most of the site would be reduced to a greater extent than groundwater levels. Groundwater levels are anticipated to decline by approximately 1 foot, from 4 feet NGVD to 3 feet NGVD, as a result of reduced elevation of the channel thalweg near the beach. The channel thalweg upstream would be lowered by up to 4 feet between the Lagoon Drive homes and the parking lot (Figure 4.3.1-1). Because this is greater than the decline in groundwater levels, flows in Redwood Creek would be less likely to be subject to channel drying and would be more likely to have flows throughout the dry season. The change in evaporation and ETo would be negligible because the change in acreage of open water versus vegetated habitats would be small compared to existing conditions.

In addition, the potential for channel drying could be decreased due to pools created by placement of LWD, which could provide areas of surface water throughout the dry season depending upon groundwater levels and evaporation.

By Year 50, although a rise in sea level would increase groundwater levels, channel aggradation is anticipated to offset this increase.

Restoration Alternative 3: Minor Adverse. The effects of the interim flood reduction measures would be the same as those described under Restoration Alternative 2, above.

Under the restoration, flows entering the site would not be changed by the project and would continue to be dry in approximately 1 out of 3 years. Once on the site, however, evaporation losses would be increased as a result of the increased extent of open water habitat. In addition, excavation of the lagoon bottoms would lower groundwater levels in the immediate vicinity of the small lagoons by several feet. Although water is anticipated to always be present in the small lagoons during the dry season (with depths ranging from 4 feet in the dry season to 8 feet during the wet season, subject to interannual variation), the reduction in groundwater levels could result in reduced instream flows in Redwood Creek. This reduction would be caused by the thalweg elevation of the creek being higher than the groundwater level in the zone of influence of the lagoons. This would also be reflected in decreased flows downstream. The potential for a dry channel during the dry season would be increased.

By Year 50, the small lagoons would have filled in, and conditions would be more similar to Alternative 2. The lagoons at this time would be approximately 1-foot deep during the dry season, increasing to 5 feet deep during the wet season.

Restoration Alternative 4: Minor Adverse. The effects of the interim flood reduction measures would be the same as those described under Restoration Alternative 2, above.

Under the restoration, impacts would be similar to Alternative 3, although the greater depth of excavation under Alternative 4 could reduce groundwater levels by as much as 4 feet. Water is anticipated to always be present in the large lagoon during the dry season (with depths ranging from 4 feet in the dry season to 8 feet during the wet season, subject to interannual variation).

Evaporation associated with the large lagoon would be even greater, reducing dry season flows by as much as 5%. Overall, this alternative has the greatest potential for channel drying during the dry season.

The lagoon feature would persist through Year 50, although its decreased depth by that time would attenuate its effects on instream flow to some degree. The lagoons at this time would be approximately 3 feet deep during the dry season, increasing to 7 feet deep during the wet season.

Impact WP-R3: Temporary Dewatering Effects (Short-Term, Year 0)

Once the restoration is complete, flows will be redirected to the realigned channel. If the transition occurs during the dry season, it is possible that the flows in the new channel would be lost to percolation because the new channel substrate would not be saturated. The duration of such an effect would be short-term and would cease once the channel bottom was saturated and connectivity between surface flow and groundwater was restored.

Restoration Alternative 1: Negligible. Periodic maintenance dredging could require temporary flow diversions to allow work in the channel. However, flow diversions would be short-term (several weeks at most), and flows would be restored to the channel once dredging activities were complete.

Restoration Alternatives 2, 3, 4: Negligible. The transition from the old Redwood Creek channel to the new Redwood Creek channel could result in reduced instream flows as the new channel substrate was wetted and percolation losses exceeded inflows. This would be a temporary effect that would be reversed as the channel substrate became saturated. The potential for channel drying could also be reduced by performing this change outside the dry season when flows are higher and the ground is already saturated.

Impact WP-R4: Reductions in Flood Elevations in the Near-Term (Short-Term, Year 5)

As previously described, the project site serves as the floodplain of Redwood Creek and is subject to periodic inundation as part of its natural function. This flooding provides benefits in ecological function at the site, as described in Section 4.4.1. The adverse effects of flooding are a result of the risk to life and property, given the infrastructure and other structures that are located in the floodplain.

Results of hydraulic models showed that gains in flood benefits can be achieved in the more frequent, lower intensity events under all of the alternatives. In large events, such as a 50-year event, flood elevations are generally unchanged from the existing conditions. Flooding at the project site could be changed as a result of several factors. First, all of the action alternatives would restore a more uniform channel gradient and defined channel, resulting in fewer impediments to flow and improved channel conveyance. This would reduce the potential for out-of-bank flows during smaller storm events and speed delivery of flood flows to the ocean. During moderate events that inundate the floodplain, the volume of floodplain storage (e.g., the lagoons in Alternatives 3 and 4) would also attenuate flood levels to some degree. However, such storage is quickly filled, and, in larger storms, roughness in the floodplain is the primary factor that affects conveyance. For instance, the open water under Restoration Alternative 4 would not provide the same impediment to flow as vegetation.

Overall, structures on the floodplain would be subject to less frequent flooding because flows at or below the approximate Q2 flow interval would be contained within the channel (channel capacity upstream of Pacific Way would be increased from an estimated 270 cfs under existing conditions to approximately 560 cfs under design conditions). It is possible but unlikely that the Restoration Alternatives would reduce flooding to a degree that would remove structures from the 100-year floodplain.

Restoration Alternative 1: Negligible. Periodic maintenance dredging under the No Action Alternative would have small short-term benefits of reducing flooding risks during small to moderate storm events as a result of the improved channel conveyance provided by these actions. However, overall, annual flooding and road closure on Pacific Way would continue, with risks similar to existing conditions for homes on Lagoon Drive and Hwy 1 upstream of Pacific Way, and garages on Pacific Way. Flood levels for Restoration Alternative 1 are shown on Figure 4.3.1-2. Q5, Q50, and Q100 flood levels, in comparison to Restoration Alternatives 2 and 4, are shown on Figures 4.3.1-3, 4.3.1-4, and 4.3.1-5, respectively. A cross section of the site, showing flood levels for both Q5 and Q100, is shown in Figure 4.3.1-6.

Under Restoration Alternative 2, downstream of Pacific Way, channel capacity would be reduced somewhat (from an estimated 340 cfs under existing conditions to approximately 300 cfs under design conditions), resulting in somewhat more frequent floodplain inundation. This would be downstream of, and hence would not affect, any structures, but it would allow for other benefits such as maintenance of floodplain vegetation, and provision of fish habitat as discussed in Section 4.3.2.3, *Fisheries*. Data from Water Years 1998–2006 (excluding 2004 and 2006, which had incomplete data) indicate that flows as measured at the Pacific Way Bridge exceed 300 cfs on average approximately 7 times per year, although the actual number is highly variable from year to year.

Restoration Alternative 2: Minor Beneficial. Interim flood reduction actions would have minor benefits that would be similar to the periodic maintenance dredging activities described for Restoration Alternative 1, above.

Once restoration is complete, all storms smaller than the Q1.5-2 event would be contained within the channel upstream of Pacific Way and would not result in flooding within the floodplain. Under moderate events, this alternative would reduce flood elevations slightly as a result of a more uniform channel gradient, leading to improved conveyance. Relative to existing conditions, Q5 flood levels would be reduced by 1–2 feet in the reach between the Pelican Inn and the residences on the downstream end of Pacific Way. In areas upstream and downstream of this reach, reductions in flood elevations would be between 0 and 1 foot. Under Q50 and Q100 conditions, floodplain roughness would be the dominant force guiding conveyance. Because the site would have similar or even higher roughness than existing conditions, Q50 and Q100 conditions would be more similar to the existing conditions. Flood levels for Restoration Alternative 2 are shown on Figure 4.3.1-7. Q5, Q50, and Q100 flood levels, in comparison to Restoration Alternatives 1 and 4, are shown on Figures 4.3.1-3, 4.3.1-4, and 4.3.1-5, respectively. A cross section of the site, showing flood levels for both Q5 and Q100, is shown in Figure 4.3.1-8.

Restoration Alternative 3: Minor Beneficial. Interim flood reduction actions would have the same minor benefits as under the other action alternatives.

Flood reduction benefits of the restoration action would be similar to those of Alternative 4, although benefits would be slightly reduced as a result of the smaller amount of floodplain storage/conveyance afforded by the small lagoons compared to the large lagoon.

Restoration Alternative 4: Minor Beneficial. Interim flood reduction actions would have the same minor benefits as under the other action alternatives.

Once restoration is complete, all storms smaller than the Q1.5-2 event would be contained within the channel and would not result in flooding within the floodplain. Under moderate events, this alternative would reduce flood elevations as a result of the more uniform channel gradient and the large lagoon, leading to increased floodplain storage and improved conveyance. Relative to existing conditions, Q5 flood levels would be reduced by 1–3 feet in the reach between the Pelican Inn and the residences on the downstream end of Pacific Way. In areas upstream and downstream of this reach, reductions in flood elevations would be between 0 and 1 foot. Under Q50 and Q100 conditions, flood levels would be lowered by up to 1.5 feet between the Pelican Inn and the residences on the downstream end of Pacific Way as a result of the reduced roughness of the large lagoon. Flood levels would be comparable to existing conditions in areas upstream and downstream of this reach. Flood levels for Restoration Alternative 4 are shown on Figure 4.3.1-9. Q5, Q50 and Q100 flood levels, in comparison to Restoration Alternatives 1 and 2, are shown on Figures 4.3.1-3, 4.3.1-4, and 4.3.1-5, respectively. A cross section of the site, showing flood levels for both Q5 and Q100, is shown in Figure 4.3.1-10.

Impact WP-R5: Reductions in Flood Elevations over the Long-Term (Long-Term, Year 50)

Flood elevations throughout the lifetime of the project would be driven by the same mechanisms as those described under Impact WP-R3, above. Given the shallow channel gradient in the Big Lagoon area and the elevated levels of sediment delivery compared to historical conditions, the site would remain a naturally depositional area. Upstream and downstream controls on channel elevation (the Hwy 1 bridge and the Pacific Ocean, respectively) make it impossible to design a channel gradient steep enough to pass all sediment to the ocean. In other words, these constraints make it impossible to create a system that is "steep" enough to avoid some sediment deposition. As a result, material would continue to deposit on the floodplain, which in combination with increased sea levels, would cause increased flood elevations over time. Both episodic changes in site morphology (e.g., debris blockages, rapid sediment deposition during large events, channel avulsion) and long-term trends (sea level rise, gradual channel aggradation) would be likely to result in somewhat increased flood elevations compared to Year 5 conditions for the action alternatives. The project site would continue to serve as the floodplain of Redwood Creek and be subject to periodic inundation as part of its natural function.

Note that this discussion does not address the effects of the replacement of the Pacific Way Bridge on flooding of Pacific Way. For a discussion of the bridge replacement with respect to flooding, refer to Impacts WP-B1 and PS-B4.

Restoration Alternative 1: Moderate Adverse. Periodic maintenance dredging under the No Action Alternative would maintain flooding levels at similar levels to existing conditions. Annual flooding and road closure on Pacific Way would continue, with risks similar to existing conditions for homes on Lagoon Drive and Hwy 1 upstream of Pacific Way and garages on Pacific Way. In addition, ongoing channel aggradation in the reach upstream of Pacific Way would continue, and avulsion would become more likely over time, with the channel reverting to the low point of the valley. This would likely cause damage of undetermined extent to Pacific Way and would almost certainly increase the frequency with which Pacific Way is impassible. Management intervention, either to cause the channel to readopt its currently alignment or elevate Pacific Way above the new channel, would be necessary. Issues with emergency access could be significant during the interim period while such a solution is implemented. The risk of avulsion and resulting risk to life and property are considered a moderate and significant impact over the long term. No feasible mitigation is available for this impact.

Restoration Alternative 2: Negligible. Over the long term, gradual sediment deposition would result in flood levels that are similar to existing conditions.

Restoration Alternative 3: Minor Beneficial. Over the long term, the small lagoons under Alternative 3 would be filled with sediment, resulting in a site configuration that is more similar to Alternative 2 at Year 5. On this basis, flood elevations are anticipated to be similar to Alternative 2 at Year 5, with elevations 0–2 feet lower than existing conditions, depending on location.

Restoration Alternative 4: Minor Beneficial. The large lagoon under Alternative 4 would also become partially filled with sediment but would still provide increased flood storage and reduced floodplain roughness relative to existing conditions. Flood elevations would therefore continue to be reduced by up to 3 feet compared to existing conditions.

Impact WP-R6: Effects on Site Soils (Short-Term, Years 0 and 5)

Soils on much of the site have been manipulated over time and are not considered native, although the time elapsed since disturbance has likely returned the soil profile in most locations to a somewhat restored condition. Construction of the restoration project would involve ground disturbance, which would disrupt the existing soil profile in areas of excavation or fill. Topsoil would be stockpiled and reused onsite to the greatest extent possible, reducing this effect. Erosion of these stockpiles would be minimized through implementation of BMPs (e.g., watering, other methods of stabilization). Over the long term, natural pedogenetic processes would cause new soil profiles to develop. Soils in disturbed areas, while not necessarily identical to preproject conditions, would be functionally recovered within the lifetime of the project.

Restoration Alternative 1: Negligible. Periodic maintenance dredging would not involve activities outside the channel that could affect soils or soil erosion.

Restoration Alternatives 2, 3, 4: Minor Adverse. All action alternatives would involve soil disturbance. The more intensive alternatives (Alternatives 3 and 4) would have a greater extent of disturbance. However, because soils would recover over time, effects are considered short term and minor. Deposition over time would help build the soil profile.

Impact WP-R7: Geohazards (Long-Term, Years 0, 5 and 50)

Although the project site is subject to seismic hazards such as strong ground-shaking and liquefaction, none of the Restoration Alternatives would involve construction of structures that would be subject to damage in such events, nor would they alter the risk of hazard (e.g., landslide).

Restoration Alternatives 1, 2, 3, 4: Negligible.

Impact WP-R8: Ability to Accommodate Sediment Loads and Maintain Equilibrium Channel Form During Average Sediment Delivery Conditions (Long-Term, Years 5 and 50)

All action alternatives have been designed with more uniform channel gradients that would more efficiently pass sediment than under existing conditions. This factor, along with the relocation of the channel to the low point of the valley and construction of berms along the side of the channels, would help maintain channel form over time. However, elevated sediment loads and constraints on channel elevation at the upstream and downstream end of the project site prevent development of an alternative that would pass all sediment to the ocean.

The lagoons in Alternatives 3 and 4 would serve as sediment sinks, and estimated net sediment deposition over the long term is shown in Table 4.3.1.1-3. Gradual

sediment deposition and channel aggradation over time, resulting from the fact that this is a depositional reach and increased by sea level rise, could cause the as-built channel to become wider and shallower over time, increasing the frequency of out-of-bank flows and, therefore, the potential for channel avulsion.

Table 4.3.1.1-3. Estimated Sediment Deposition Volumes for Restoration Alternatives

Restoration Alternative	Assumed Bedload Trapping[1] (%)	Annual Bedload Delivery[2] (cy/yr)	Assumed Suspended Sediment Trapping[1] (%)	Annual Suspended Sediment Delivery[2] (cy/yr)	Estimated 50-Year Total Deposition (cy)	Lagoon Capacity at Year 0 (cy)
1	80	375	25	2,300	43,750	n/a
2	30	375	15	2,300	22,875	n/a
3	50	375	30	2,300	43,875	~100,000
4	100	375	50	2,300	76,250	~170,000

Source: Philip Williams & Associates et al. 2003; Stillwater Sciences 2003.

cy = cubic yards

cy/yr = cubic yards per year

[1] Estimated average trapping efficiency over 50-year time horizon. Trapping efficiency would vary over time.

[2] Assumes sediment delivery occurs on an average rather than episodic basis.

Restoration Alternative 1: Moderate Adverse. Elevated sediment delivery compared to pre-1840 conditions would continue, and the insufficient gradient of the current confined channel would result in continued channel aggradation. This would be exacerbated by sea level rise in the long term, which would further reduce the ability to pass sediment. The need for periodic maintenance dredging would be likely to increase as the channel continues to aggrade. In addition, under existing conditions, flows from the Green Gulch tributaries entering the mainstem via culverts would continue to have a tendency to become plugged with sediment, or would need to be manually manipulated. This impact is considered significant and unavoidable.

Restoration Alternative 2: Moderate Beneficial. The SAM analysis conducted by PWA (2004) and described in the methodology discussion above concluded that the design channel bottom width of 35 feet would be stable given the channel slope and expected variance in average sediment delivery. As a result, this alternative is designed to pass the majority of sediment to the ocean. The major geomorphic changes anticipated over the 50-year project lifetime are floodplain deposition and aggradation of the channel bed in response to sea level rise, which was estimated at approximately 0.7 foot over the next 50 years (for a discussion of the assumptions related to sea level rise, refer to "Sea Level Rise," in Section 3.1.1, *Watershed Processes*). These anticipated features of the natural system are not considered adverse effects, and the channel is expected to remain stable within a dynamic range (e.g., gradual channel migration while retaining similar channel form). The berms constructed on either side of the channel would help provide channel stability by allowing for establishment of riparian vegetation.

Downstream of Pacific Way, where the channel would accommodate about a 1-year flow, the berms will help maintain channel definition by resisting invasion by cattails. Additionally, if a phased approach were implemented to construct the downstream portions of the Restoration Alternative before the bridge is constructed, a temporary channel from the existing bridge to the new channel in the pasture would be constructed to maintain channel stability.

Restoration Alternative 3: Moderate Beneficial. This alternative would be similar to Alternative 2; however, the small lagoons would function as sediment traps and reduce delivery of sediment to the ocean. It is anticipated that these lagoons would be mostly filled in by Year 50, but this evolution would not interfere with maintenance of channel form.

Restoration Alternative 4: Moderate Beneficial. This alternative would be similar to Alternative 3 except that the large lagoon would provide greater depositional capacity over the 50-year project life than Alternative 3.

Impact WP-R9: Ability to Accommodate Sediment Loads and Maintain Equilibrium Channel Form During Episodic Events (Long-Term, Years 5 and 50)

Although site evolution would generally be gradual over time, as described in the previous impact, episodic events (e.g., large storms, fires) could deliver large amounts of sediment or cause other geomorphic changes on the site that could result in channel avulsion or other factors leading to fundamental changes in the as-built channel form. Large storm events and wet winters proportionally deliver more sediment and debris than average conditions and account for the majority of depositional events.

Restoration Alternative 1: Moderate Adverse. Episodic events could cause large changes, such as channel avulsion and/or loss of a defined channel. This would be exacerbated over time as elevated sediment delivery caused channel aggradation and made the existing channel more susceptible to out-of-bank flows. In addition, under existing conditions, flows from the Green Gulch tributaries entering the mainstem via culverts would continue to have a tendency to become plugged with sediment, or would need to be manually manipulated. This impact is considered significant and unavoidable.

Restoration Alternative 2, 3, 4: Moderate Beneficial. LWD that would be installed as part of project construction (and located downstream of Pacific Way consistent with the most recent hydraulic flood modeling), and naturally forming debris jams, could serve as blockages to sediment passage during larger events. Although this is a natural part of stream evolution, it could result in decreased water depths in these locations, which could change channel form or alter the channel gradient, such that overall sediment passage to the ocean (or lagoon features) was reduced and channel aggradation occurred. On balance, these large events could also flush or otherwise reconfigure the site to improve sediment passage. Regardless, maintenance could be indicated if sediment deposition or changes in channel form posed flooding threats to structures in the floodplain or otherwise resulted in undesirable conditions (e.g., loss of adequate fish passage).

However, the need for such maintenance is considered less likely than under existing conditions because of the more uniform channel gradient and the relocation of the channel to the low point in the valley. Additionally, if a phased approach were implemented to construct the downstream portions of the Restoration Alternative before the bridge is constructed, a temporary channel from the existing bridge to the new channel in the pasture would be constructed to maintain channel stability.

Impact WP-R10: Persistence of Backwater Features and Potential for Channel Avulsion (Long-Term, Years 5 and 50)

Restoration Alternative 1: Moderate Adverse. The channel bed is currently perched above the adjacent floodplain, which creates conditions for avulsion that could occur during a storm event. As sediment continues to deposit in the stream channel upstream of Pacific Way, the channel would continue to aggrade, and the potential for channel avulsion would increase. Periodic maintenance dredging would reduce the potential for such an event to some extent but would not eliminate the overall likelihood of avulsion.

In the event of channel avulsion, the stream channel would be most likely to relocate to the low point of the valley in Green Gulch pasture, and the new stream channel could take several years to establish. Flows out of an avulsed channel would be constrained by the levee road at the downstream end, creating further flooding and fish stranding issues. In the vicinity of Pacific Way, the paved roadway would constrain the establishment of a new stream channel at that location. The potential also exists for a “swampy meadow” scenario, with sheet flow through the pasture and no defined stream channel.

Because the likelihood of avulsion will increase over time, this impact is considered significant and unavoidable.

Restoration Alternative 2: Moderate Beneficial. Relocation of the stream channel to the low point in the valley and the use of berms to confine Q1.5 to Q2 flows (upstream of Pacific Way) and Q1 flows (downstream of Pacific Way) would help maintain a defined stream channel and reduce the potential for channel avulsion. Large events may periodically flush out or fill in backwater channel features, and the potential exists for such events to cause channel avulsion toward the backwater channel(s), which may become the dominant channel.

Backwater features are most likely to experience deposition where they meet the active channel of Redwood Creek because flows backwatering into the adjacent backwater feature would rapidly reduce in velocity and drop sediment out of suspension. At some point, this deposition could hydrologically isolate the backwater features from the main stream channel.

Overall, relocation of the channel to the low point would greatly reduce the potential for avulsion. Although avulsion to the backwater channels is possible, this would not necessarily be a negative outcome unless it threatened infrastructure (e.g., Pacific Way) or buildings or had other unwanted

consequences (e.g., loss of fish passage). In these cases, management intervention could be indicated. Additionally, if a phased approach were implemented to construct the downstream portions of the Restoration Alternative before the bridge is constructed, a temporary channel from the existing bridge to the new channel in the pasture would be constructed to maintain channel stability.

Restoration Alternative 3: Moderate Beneficial. Impacts would be similar to Alternative 2. The western lagoon would function similarly to the downstream backwater channel in Alternative 2, although its increased areal extent would be likely to increase the period of persistent backwater features. Avulsion to the western lagoon could occur at some point, but this would not be considered an adverse impact unless it posed some sort of threat, as described under Alternative 2.

Restoration Alternative 4: Major Beneficial. The presence of the large lagoon would greatly reduce the potential for channel avulsion because backwater features would not be present on the site. As sediment settled at the mouth of the lagoon, a "delta" would form, which would foster the creation of new backwater features in that lagoon.

Impact WP-R11: Potential for Channel Incision (Long-Term, Years 5 and 50)

Restoration Alternative 1: Negligible. Because of the current channel gradient, sediment loads would most likely lead to channel aggradation, rather than channel incision. Some scouring has occurred in recent years downstream of the Pacific Way Bridge, but deposition upstream indicates that this would not likely to lead to large-scale incision.

Restoration Alternatives 2, 3, 4: Negligible. All Restoration Alternatives have been designed with channel gradients that are appropriate to the types and volumes of sediment delivery. Elevated sediment loads are anticipated to result in a system that continues to be depositional, and channel aggradation is a more likely scenario. In the unlikely event that channel incision occurred, downcutting that extended off of the project site on Redwood Creek and on the Green Gulch tributaries would be limited by upstream grade controls, namely the box culvert on the Hwy 1 crossing of Redwood Creek and the concrete lining on the Green Gulch Farm tributaries.

Impact WP-R12: Effects of Sediment Delivery on Nearshore Coastal Habitat, Beach Replenishment, and Dune Formation (Long-Term, Years 5 and 50)

The sediment supply to Muir Beach and the Pacific Ocean from Redwood Creek is very low compared to longshore transport. Annual littoral sediment transport volumes are estimated at between 150,000 and 250,000 cubic yards per year. In contrast, sediment delivery to the ocean from Redwood Creek is estimated at approximately 1,150 cubic yards per year under Alternative 4, 1,800 cubic yards per year under Alternatives 1 and 3, and 2,200 cubic yards per year under Alternative 2. These figures represent between 0.5 and 1.5% of total sediment

supply to the nearshore coastal zone and Muir Beach, and because much of it is fine-grained, it may not contribute substantially to beach formation. No significant changes to beach formation processes or the nearshore coastal environment are anticipated because of changes in sediment discharge. (Philip Williams & Associates 2004)

Over the 50-year time horizon of the project, sea level rise is anticipated to cause about 20–30 feet of beach retreat. The net width of Muir Beach should stay about the same if sediment supplies are not significantly altered, and the beach will migrate landward 20–30 feet. Under all alternatives, there is adequate space on the project site seaward of the parking lot to accommodate this beach retreat.

Restoration Alternative 1: Negligible. Beach processes would continue according to existing conditions.

Restoration Alternatives 2, 3, 4: Minor Beneficial. All action alternatives would improve the potential for inland dune formation by moving the lower portion of Redwood Creek toward the ocean. Windblown sand accumulation could result in the formation of dunes, although the extent of such dune formation is uncertain; the majority of dune aggradation is anticipated toward the southeast end of the beach due to prevailing wind patterns. Note that as sea level rise continues, this inland dune formation would be offset by beach retreat. In other words, the entire beach and tidal lagoon system is anticipated to migrate landward in response to sea level rise.

Impact WP-R13: Effects on Tidal Lagoon Opening and Closure, and Overall Tidal Lagoon Function (Long-Term, Years 5 and 50)

Lagoon closure is driven primarily by the relative dominance of wave and tidal forces over the low flows from Redwood Creek in summer. Wave action pushing sand landward builds a summer beach berm, behind which streamflows are lost to seepage and evaporation, causing the lagoon to close. In late fall, once flows in Redwood Creek become high enough to fill the lagoon and overtop the beach berm, flows once again reach the ocean and open the lagoon, quickly scouring a channel through the sand. The exact dates associated with lagoon opening and closure vary based on seasonality of flows in Redwood Creek.

None of the alternatives are anticipated to alter these seasonal patterns or the processes driving lagoon opening and closure, and therefore no substantial changes to this process are anticipated. Further, as discussed above under Impact WP-R11, sediment delivery from Redwood Creek does not provide a significant source of sand that would affect beach formation and would not therefore affect tidal lagoon opening and closure.

The potential for channel realignment in the lower reach of Redwood Creek and other restoration actions to affect the tidal lagoon is described below.

Restoration Alternative 1: Negligible. No actions would be taken that could affect the tidal lagoon.

Restoration Alternatives 2, 3, 4: Moderate Beneficial. Under all action alternatives, the lower portion of the Redwood Creek channel would be realigned closer to the beach, in less consolidated, sandier material. This would improve the ability for scour and channel migration. In addition, expansion of the tidal lagoon and installation of LWD would enhance the dynamic quality of the lagoon and improve tidal lagoon function.

Impact WP-R14: Effects of Sea Level Rise (Long-Term, Years 5 and 50)

As described in Chapter 3, "Affected Environment," sea levels are anticipated to rise over the lifetime of the project, although the estimates of the extent of sea level rise vary. Sea level rise of 0.7 foot over 50 years was assumed in this Final EIS/EIR, based on published IPCC data (for a discussion of the assumptions related to sea level rise, refer to "Sea Level Rise," in Section 3.1.1, *Watershed Processes*). Although sea level rise is not an effect of the project, it would influence the project. Sea level rise would have several effects: 1) it would cause beach migration inland; 2) it would raise groundwater levels on the site; 3) it would reduce the ability of the site to deposit or pass sediment, leading to sediment deposition at the site over the long term; 4) it could increase flood levels over time as a result of increased sediment deposition. These various effects of sea level rise have been discussed throughout the other impact discussions above.

In the face of sea level rise, the lagoons in Alternatives 3 and 4 would continue to provide additional flood storage/conveyance and sediment storage capacity over time, partially offsetting the loss of sediment conveyance capacity and increased effects of high tides on upstream flooding resulting from sea level rise. Alternative 2, because it has less sediment storage capacity, would be affected to the greatest extent, and flood levels over the 50-year time horizon under this alternative are anticipated to approximate existing conditions as a result of combined sediment deposition and sea level rise (see discussion of long-term flooding changes under Impact WP-R5). Note that this does not account for any flooding benefits afforded by replacement of the Pacific Way Bridge.

Public Access Alternatives

Table 4.3.1.1-4 summarizes the potential impacts of Public Access Alternatives on watershed processes in the study area. The Public Access Alternatives are described in Chapter 2.

Table 4.3.1.1-4. Watershed Process Impacts—Public Access Alternatives

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
WP-P1: Alteration of Flood Elevations from Parking Lot and Picnic Area Configuration/ Location	Negligible	Minor Beneficial	Negligible	Minor Beneficial	Minor Beneficial	Minor Adverse	Minor Beneficial	
WP-P2: Effects on Site Soils	Negligible	Negligible	Negligible	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
WP-P3: Geohazards	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
WP-P4: Alteration of Stream Channel Function and Geomorphic Evolution as a Result of Parking Lot Configuration	Negligible	Moderate Beneficial	Minor Beneficial	Minor Beneficial	Moderate Beneficial	Minor Beneficial	Moderate Beneficial	

Impact WP-P1: Alteration of Flood Elevations from Parking Lot and Picnic Area Configuration/Location (Long-Term, Years 5 and 50)

The Muir Beach parking lot and picnic area in their present configuration protrudes across almost the entire floodplain, constricting flood conveyance at the bottom of the valley through a 50 foot–wide area, and having the effect of removing storage from the floodplain. Modeling indicates that backwater effects from the lower 90 feet of the lot and picnic area occur for storms greater than approximately the Q2 event, and increased flood levels propagate approximately 750 and 800 feet upstream during the Q5 and Q50 events, respectively. Flood levels immediately upstream of the lower 90 feet of the lot in the Q5 event are raised approximately 1 foot by the lot. Under larger events (approximately Q50 and greater), the parking lot would be overtopped and would present less of an impediment to flood flows. Over time, the backwater effect of the lower end of the parking lot would also lead to increased upstream sediment deposition and therefore increased elevations in the floodplain.

All the Public Access Alternatives involve removing the lower 90 feet of the parking lot and picnic area, combined, to allow for improved conveyance through this lower reach. Modeling of the Restoration Alternatives assumed this as a baseline; therefore, flood levels presented in Impact WP-R4 above incorporate this feature. Modeling indicates that the 90-foot setback reduces Q5 flood levels by 0.7 foot immediately upstream of the lot. Implementation of larger setbacks yield only marginal benefits (modeling showed that a setback of 300 feet reduced levels only by an additional 0.2 foot). Therefore, Restoration Alternatives with a

setback larger than 90 feet would not have a substantial effect in terms of lowering flood levels.

As an additional consideration, parking lots with a smaller footprint would also provide a small amount of additional floodplain storage.

Because the modeling performed in Impact WP-R4 assumed that the lot would have a 90-foot setback, the impacts of these Public Access Alternatives are presented in comparison to the impacts of Restoration Alternatives presented under Impact WP-R4.

Note that the new pedestrian bridge from the parking lot to the beach would be designed such that it would have minimal effects on flooding.

Public Access Alternative A: Negligible. The existing parking lot would continue to create a backwater effect during floods.

Public Access Alternative B1: Minor Beneficial. The parking lot would be set back an additional 100 feet from Redwood Creek compared to the modeling presented in Impact WP-R4 and would have the smallest footprint of any alternative. This would improve both conveyance and floodplain storage, although reductions from the flood levels presented in Impact WP-R4 would only be minor (on the order of several inches).

Public Access Alternatives B2: Negligible. The configuration and footprint of this parking lot is consistent with the modeling described under Impact WR-R4, and therefore the benefits associated with reduced flood levels would be as presented in that impact discussion.

Public Access Alternative B3: Minor Beneficial. Under this alternative, the parking lot would be pulled back an additional 16 to 40 feet, in addition to the 90 feet removed under all alternatives, creating a minimum distance of 180 feet from the creek. This would result in improved conveyance during smaller storms. Impacts would be similar to those describe for Public Access Alternative B1.

Public Access Alternative B4: Minor Beneficial. Under this alternative, the parking lot would be rotated parallel to flow and would be set back approximately an additional 100 feet, similar to Public Access Alternative B1, resulting in improved conveyance during smaller storms. Impacts would be similar to those describe for Public Access Alternative B1.

Public Access Alternative B5: Minor Adverse. The parking lot would occupy the largest footprint, reducing floodplain storage and possibly slightly increasing flood levels.

Public Access Alternative C: Minor Beneficial. Because there would be only a vehicle turnaround at the beach, this parking lot would present the smallest impediment to flows, and benefits would be similar to those described above for Public Access Alternative B1. The increase in floodplain storage would be offset

to some extent by the new parking lot upstream, but this new parking lot would not be in the active conveyance area and therefore would not provide an impediment to flood conveyance.

Impact WP-P2: Effects on Site Soils (Short-Term, Years 0 and 5)

Impact mechanisms would be similar to those described for Impact WP-R5.

Public Access Alternatives A, B1, B2, B3: Negligible. Native soils would be minimally disturbed by these alternatives.

Public Access Alternatives B4, B5, C: Minor Adverse. Under these alternatives, some areas of native soil would be buried by fill for the parking lot.

Impact WP-P3: Geohazards (Long-Term, Years 0, 5, and 50)

Although the project site is subject to seismic hazards, such as strong ground-shaking and liquefaction, the infrastructure constructed as part of the Public Access Alternatives would not be subject to appreciable damage in such events in excess of baseline conditions, nor would they alter the risk of hazard (e.g., landslide).

Public Access Alternatives A, B1, B2, B3, B4, B5, C: Negligible.

Impact WP-P4: Alteration of Stream Channel Function and Geomorphic Evolution as a Result of Parking Lot Configuration (Long-Term, Years 5 and 50)

The existing parking lot reduces floodplain function and constricts the ability for the Redwood Creek channel to migrate. The setbacks provided by the reconfigured parking lots would allow for improvements in floodplain function and reduce impediments to channel migration over time. The new pedestrian bridge from the parking lot to the beach would be designed to minimize adverse effects on stream channel function and geomorphic evolution.

Public Access Alternative A: Negligible. The existing parking lot is anticipated to continue to reduce sediment transport capacity during high-flow conditions and limit the potential for channel migration.

Public Access Alternatives B2, B3, B5: Minor Beneficial. The increased setback of the parking lot under these action alternatives would improve sediment transport ability compared to existing conditions and allow for a greater area for sediment deposition by increasing the effective width of the floodplain in the vicinity of the parking lot. Although historical information indicates that Redwood Creek in the vicinity of the parking lot has historically been at or near its present location, the potential for channel migration would also be increased by reducing the parking lot footprint.

Public Access Alternatives B1, B4, C: Moderate Beneficial. Benefits would be as described above for the other action alternatives. However, because of the greater setback of the lot, benefits are considered moderate instead of minor.

Bridge Alternatives

Table 4.3.1.1-5 summarizes the potential impacts of Bridge Alternatives on watershed processes in the study area. The Bridge Alternatives are described in Chapter 2.

Table 4.3.1.1-5. Watershed Process Impacts—Bridge Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	Mitigation Measure
WP-B1: Effects of Bridge Configuration on Flooding	Negligible	**Moderate Adverse**	Moderate Beneficial	Minor Beneficial	Moderate Beneficial	BR1: no mitigation available
WP-B2: Geohazards	Negligible	Negligible	Negligible	Negligible	Negligible	
WP-B3: Alteration of Stream Channel Function and Geomorphic Evolution as a Result of Bridge Configuration	Negligible	Minor Beneficial	Negligible	Moderate Beneficial	Major Beneficial	

Impact WP-B1: Effects of Bridge Configuration on Flooding (Long-Term, Years 5 and 50)

The frequency and duration of bridge inundation, and related access issues, are discussed in Section 4.6.4 under Impact PS-B4. This impact discussion focuses on the effects of the bridge on flood elevations and related effects on structures in the floodplain, such as the Pelican Inn and homes on Lagoon Drive.

The existing roadway on Pacific Way is currently so low that it presents little obstruction to flood flows. Hydraulic modeling shows the benefits of having a road at the present grade—it keeps flood elevations low, but vehicular passage would still be obstructed during moderate events. Therefore, replacing the bridge and raising the road to reduce road flooding have the potential to create a backwater effect and increase upstream flood elevations in the vicinity of the Pelican Inn and homes on Lagoon Drive. Philip Williams & Associates hydraulically evaluated alternative bridge designs to evaluate this backwater effect. Table 4.3.1.1-6 presents the changes in flood elevations resulting from the various Bridge Alternatives' backwater effect, and identifies alternatives that would avoid these effects.

Table 4.3.1.1-6. Summary of Flood Elevations for the Modeled Bridge Alternatives under Various Design Storm Events

Bridge Alternative	Span (feet)	Bridge Deck Height (feet NGVD)	Raised Roadway	Road Elevation (feet NGVD)	Water Level near Pelican Inn (feet NGVD)			
					Q5	Q10	Q50	Q100
BR0	24	15.2	No	15	14.8	15.1	16.5	17.1
BR1	50	16.5	Yes	15.5 to 16.5	**15.5**	**16.0**	**16.8**	17.1
BR2	50	15.0	No	~11 to 15	*14.2*	*14.9*	16.5	17.1
BR3	150	16.25	Yes	15.5 to 16.25	*14.7*	15.1	*16.4*	17.1
BR4	266-300	18	Yes	~15 to 18	N/A	*14.7*	N/A	17.1

Source: Appendix D, Table 6.

Notes:

Modeled results presented in combination with Restoration Alternative 2.

N/A = not modeled.

Bold = increase in flood levels compared to existing conditions.

Italics = decrease in flood levels compared to existing conditions.

Bridge Alternative BR0: Negligible. The bridge and roadway would remain in their current configuration.

Bridge Alternative BR1: Moderate Adverse. The raised roadway and narrow bridge span would present an impediment to flows, resulting in increased flood levels at the Pelican Inn of 0.7 foot, 0.9 foot, and 0.3 foot for the Q5, Q10, and Q50 events, respectively. The Q100 event would be similar to existing conditions. The increased flooding effects on the Pelican Inn, and potentially other structures such as the homes on Lagoon Drive, could be mitigated through actions such as construction of levees or raising of structures. However, these actions would be unreasonably costly compared to implementation of one of the other Bridge Alternatives. For this reason, such mitigation is considered infeasible. This is therefore considered a significant and unavoidable adverse consequence of this Bridge Alternative.

Bridge Alternative BR2: Moderate Beneficial. Despite the narrow span of the bridge, the absence of a raised roadway would allow for improved conveyance. In other words, there would be less of a raised roadway to serve as an impediment to flows. Flood levels at the Pelican Inn would be reduced by 0.6 foot and 0.2 foot for the Q5 and Q10 events, respectively. The Q50 and Q100 events would be similar to existing conditions.

Bridge Alternative BR3: Minor Beneficial. The wide span of this bridge would allow for slightly improved conveyance of flood flows. Flood levels at the Pelican Inn would be reduced by 0.1 foot during the Q5 and Q50 events and would remain unchanged during the Q10 and Q100 events.

Bridge Alternative BR4: Moderate Beneficial. This bridge as modeled would span the entire floodplain and so would provide little impediment to flows. Modeling indicates that flood levels at the Pelican Inn would be reduced by 0.4 foot during the Q10 event and would remain the same during the Q100 event. The Q5 and Q50 events were not modeled. The updated bridge design would result in impacts that are somewhere between the results for Alternative BR3 and Alternative BR4 (as modeled).

Impact WP-B2: Geohazards (Long-Term, Years 0, 5, and 50)

The new bridge would be constructed in an area of high seismic hazard and, because of the alluvial nature of the floodplain deposits, subject to liquefaction hazard.

Bridge Alternative BR0: Negligible. Geohazards associated with the existing bridge would not change.

Bridge Alternatives BR1, BR2, BR3, BR4: Negligible. The new bridge would be designed to current seismic standards and to accommodate geotechnical issues (i.e., liquefaction). Impacts would therefore be negligible.

Impact WP-B3: Alteration of Stream Channel Function and Geomorphic Evolution as a Result of Bridge Configuration (Long-Term, Years 5 and 50)

Philip Williams & Associates (Appendix D) rated each bridge configuration based on the following three characteristics:

1. **Unsustainable Channel Migration**—likelihood of channel avulsion outside the bridge limits as a result of 1) bridge blockage (e.g., by woody debris, accumulated sediment) and/or 2) low resistance to channel headcutting (e.g., road that provides limited grade control function, by not having a raised embankment, nonerosive paving material).
   - Highest rating (5): Long/high bridge span.
   - Lowest rating (1): Short/low bridge span; at-grade road (low resistance to new channel formation).
2. **Floodplain Connectivity**—degree of 1) upstream-downstream floodplain connectivity (provides wildlife corridor crossing Pacific Way) and/or 2) lateral channel-floodplain connectivity in the vicinity of the bridge.
   - Highest rating (5): Long bridge span.
   - Lowest rating (1): Short bridge span; raised road.
3. **Natural Channel Function**—degree to which 1) channel adjustments (bank erosion and migration) are allowed without requiring armoring and 2) sediment deposition is allowed without requiring dredging or other channel maintenance (e.g., LWD removal).
   - Highest rating (5): Long bridge span.
   - Lowest rating (1): Short bridge span.

In general, longer bridge spans (Bridge Alternatives BR3 and BR4) are rated highly for relative geomorphic and ecological function. The 50-foot bridge (Bridge Alternatives BR1 and BR2) has low floodplain connectivity and channel function, with or without the raised road. However, raising the road reduces the likelihood of the channel avulsing to either side of the bridge. For this reason, the 50-foot bridge is considered to have higher geomorphic function with the raised road (Bridge Alternative BR1) than without the raised road (Bridge Alternative BR2). Ratings are as shown in Table 4.3.1.1-7 (adapted from Philip Williams & Associates, Appendix D).

Table 4.3.1.1-7. Evaluation of Geomorphic and Ecological Function of the Bridge Alternatives

			Rating (1–5)		
Bridge Alternative	Span (feet)	Raised Roadway	Channel Stability	Floodplain Connectivity	Natural Channel Function
BR0	24	No	1	1	1
BR1	50	Yes	3	1	1
BR2	50	No	1	1	1
BR3	150	Yes	4	4	5
BR4	250~~266–300~~	Yes	5	5	5

Bridge Alternative BR0: Negligible. The bridge would remain in its current configuration.

Bridge Alternative BR1: Minor Beneficial. Although channel stability would be improved by the location of the bridge span in the low point of the valley, the narrow span and raised roadway would still result in limited floodplain connectivity and natural channel function.

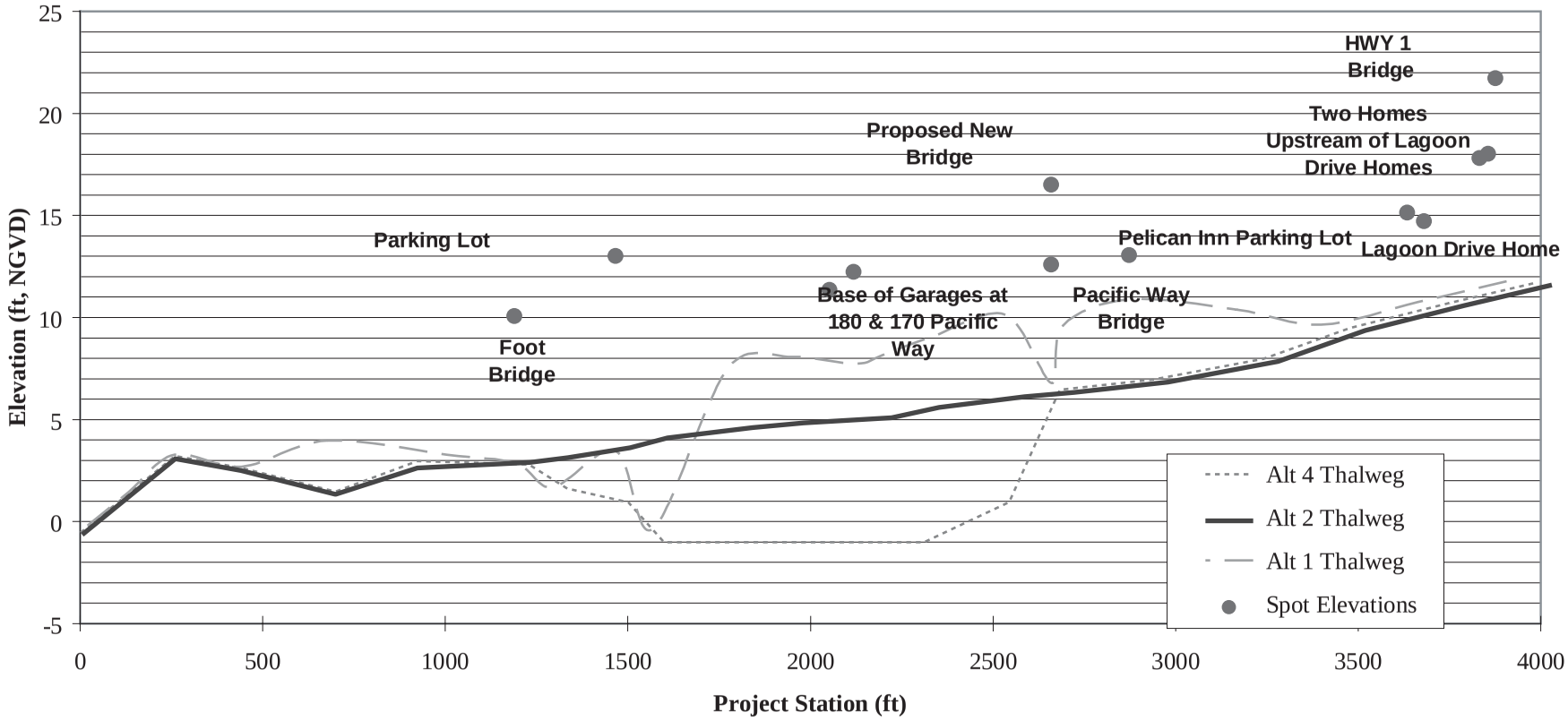
Bridge Alternative BR2: Negligible. The narrow bridge span and low roadway would result in continued concerns related to channel stability, floodplain connectivity, and natural channel function.

Bridge Alternative BR3: Moderate Beneficial. The wide span of this Bridge Alternative would greatly improve channel stability, floodplain connectivity, and natural channel function.

Bridge Alternative BR4: Major Beneficial. By spanning the entire floodplain, this Bridge Alternative would offer the greatest improvements to channel stability, floodplain connectivity, and natural channel function.

Fill Disposal Alternatives

The Fill Disposal Alternatives are not anticipated to have effects on watershed processes. All fill disposal location would be located outside of stream channels, would not contribute to flooding of structures or infrastructure, would not adversely affect native soils, and would not involve construction of permanent structures subject to geohazards.



Source: PWA 2006

05052.05 DEIS/EIR (11-06)

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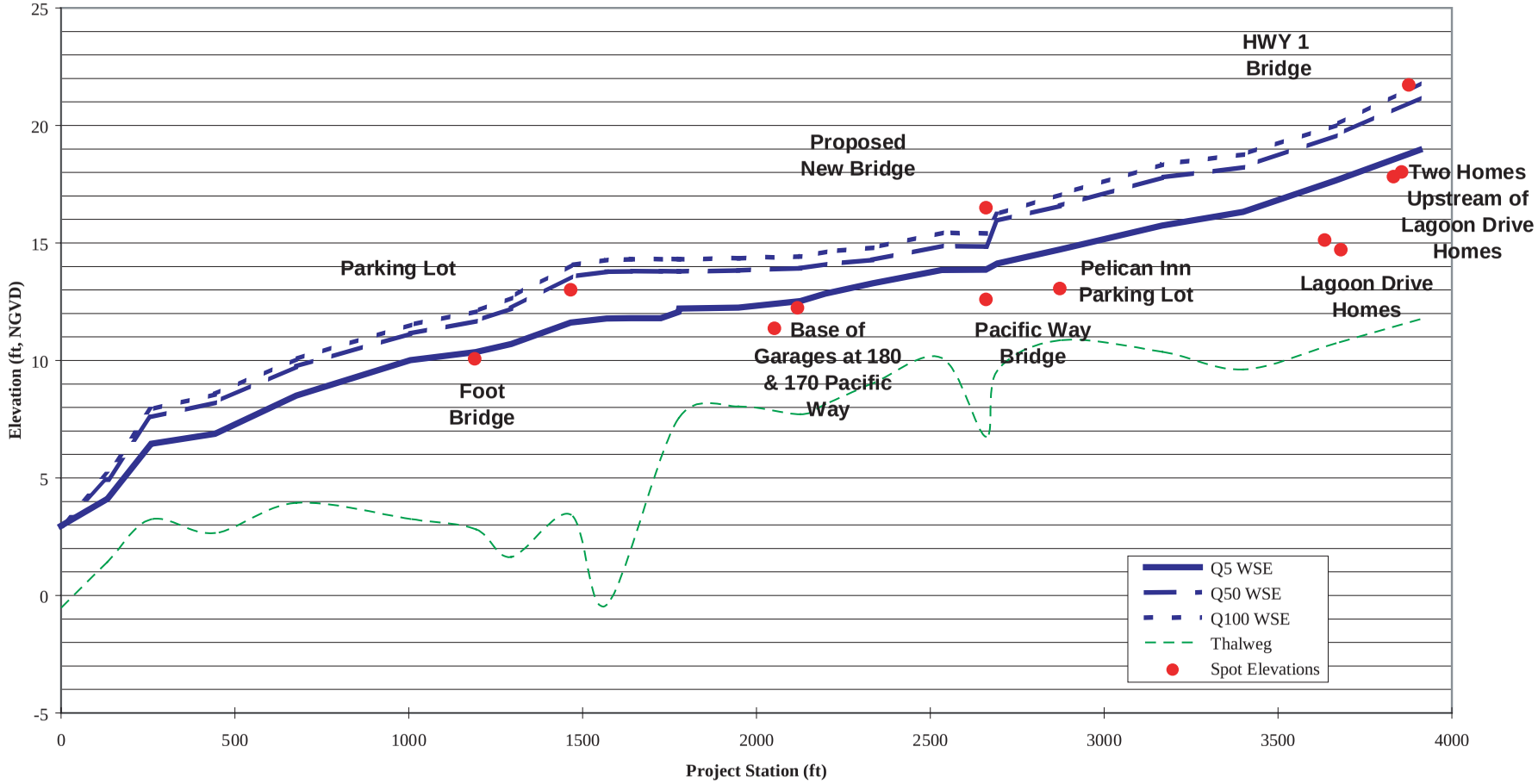
Figure 4.3.1-1
Comparison of Channel Thalweg for Alternative 1

Exhibit 2: Final Environmental Impact Statement



Notes: Chainages based on each Alternative 1 MIKE network. Spot elevations based on Alternative 1 MIKE network.

Source: PWA 2006

05052.05 ADEIS/EIR (7-06)

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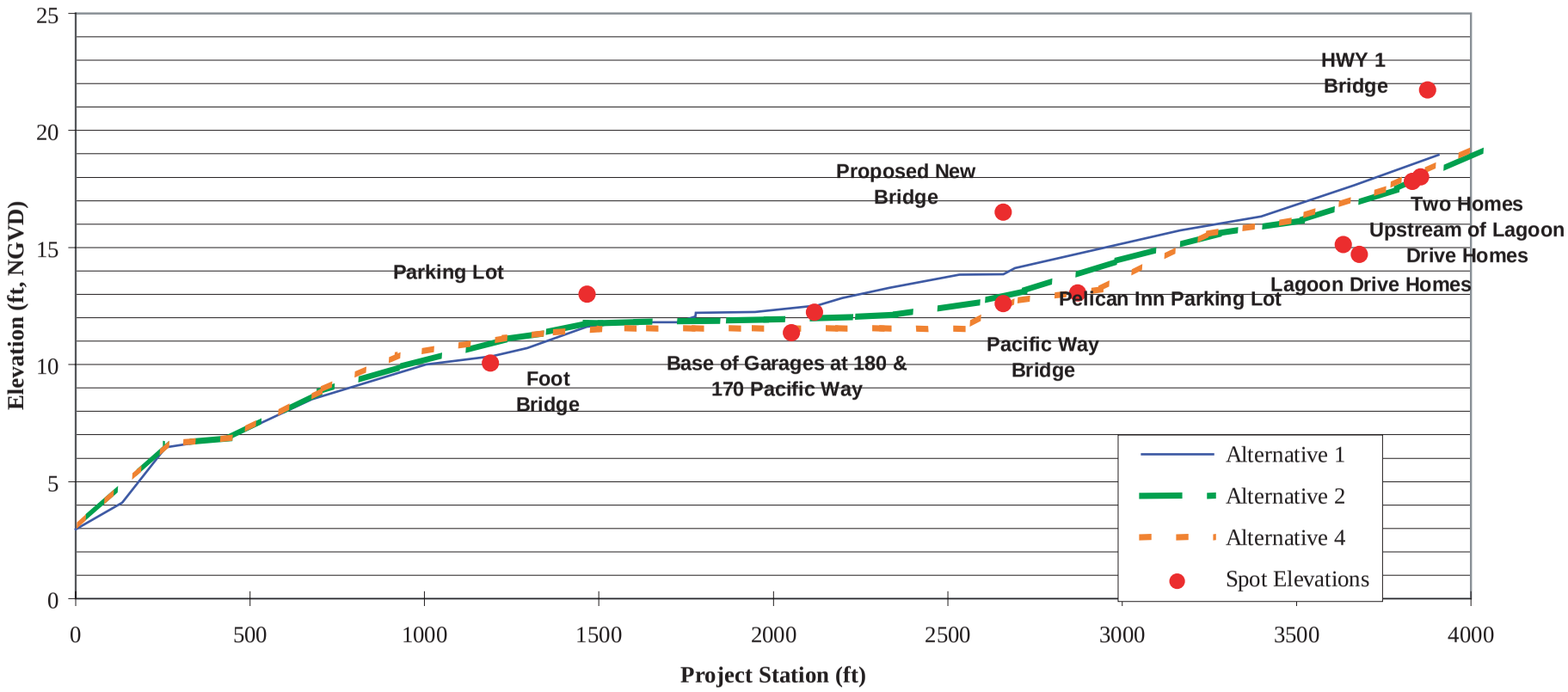
Figure 4.3.1-2
Comparison of Water Levels for Alternative 1 during Q5, Q50, Q100

Exhibit 2: Final Environmental Impact Statement



Notes: Chainages based on each Alternative's MIKE network. Spot elevations based on Alternative 1 Mike network

Source: PWA 2006

05052.05 ADEIS/EIR (7-06)

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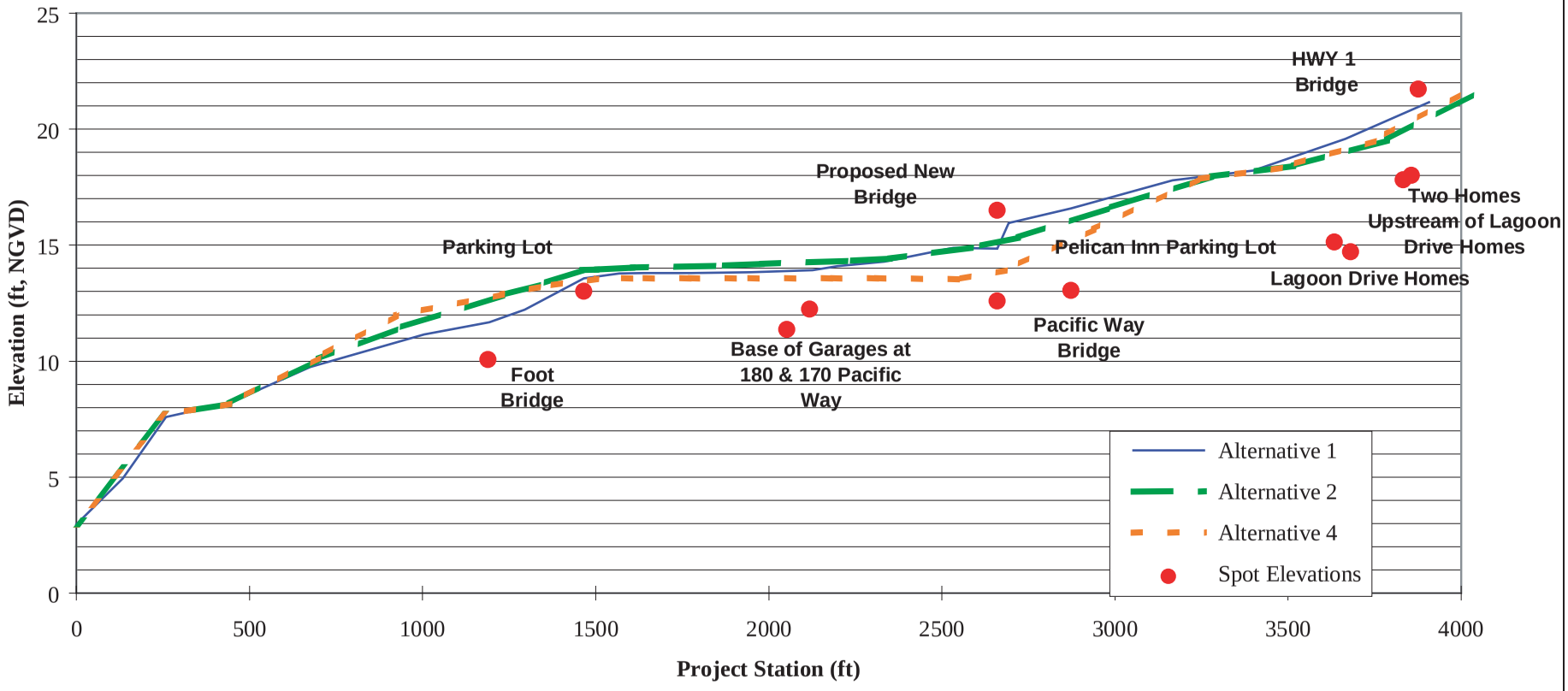
Figure 4.3.1-3
Comparison of Water Levels for Alternatives 1, 2, and 4 at Year 5 during Q5

Exhibit 2: Final Environmental Impact Statement



Notes: Chainages based on each Alternative's MIKE network. Spot elevations based on Alternative 1 Mike network

Source: PWA 2006

05052.05 ADEIS/EIR (7-06)

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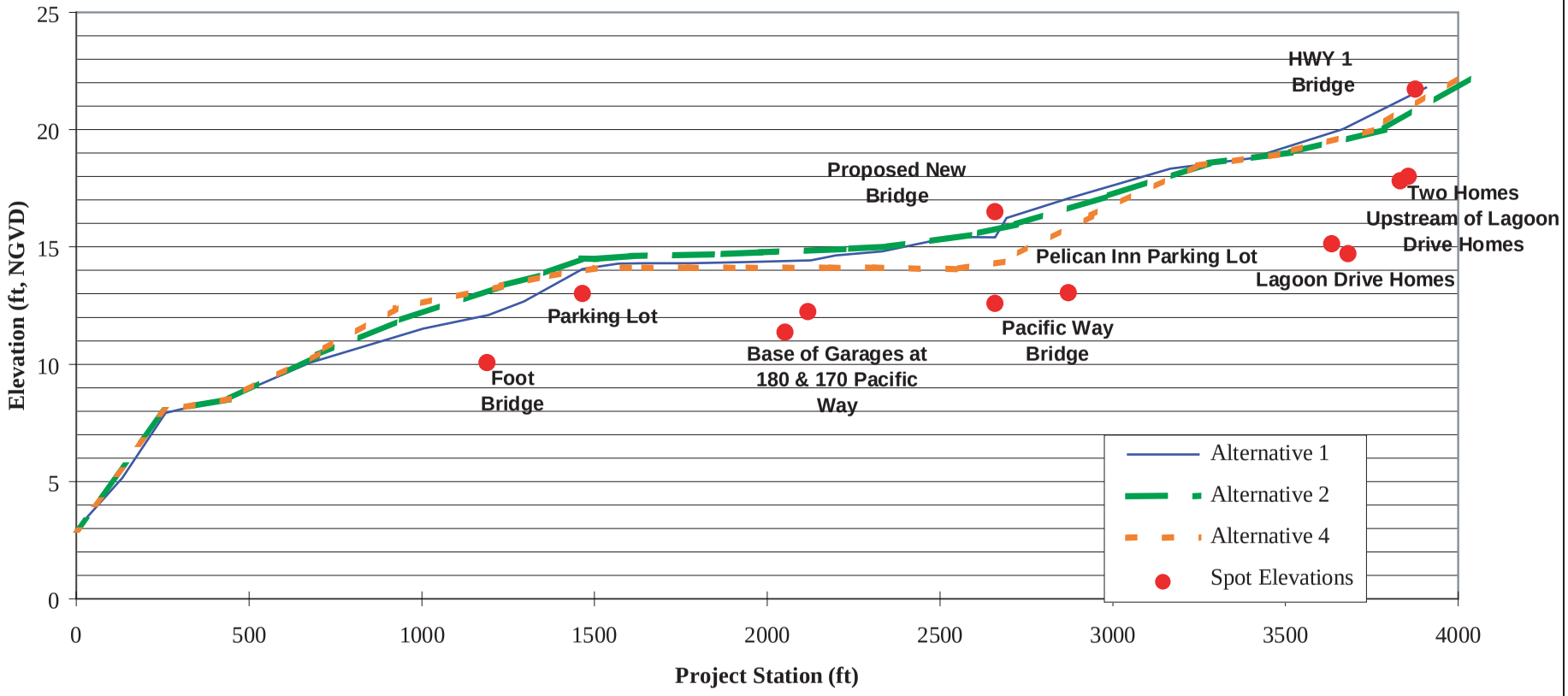
Figure 4.3.1-4
Comparison of Water Levels for Alternatives 1, 2, and 4 at Year 5 during Q50

Exhibit 2: Final Environmental Impact Statement



Notes: Chainages based on each Alternative's MIKE network. Spot elevations based on Alternative 1 Mike network

Source: PWA 2006

05052.05 ADEIS/EIR (7-06)

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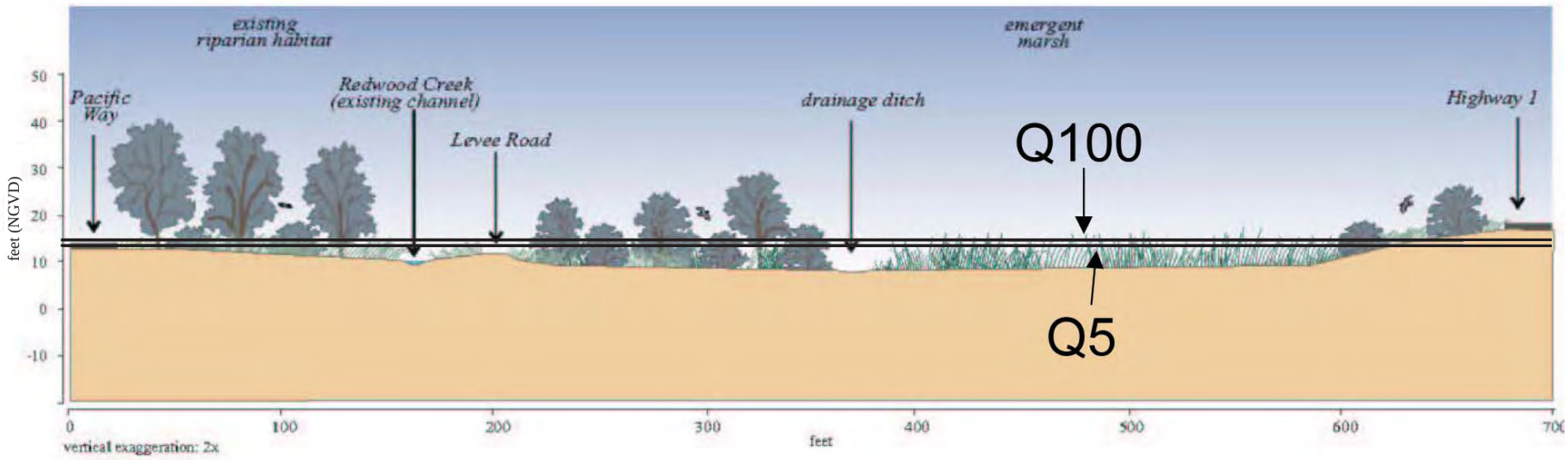
Figure 4.3.1-5
Comparison of Water Levels for Alternatives 1, 2, and 4 at Year 5 during Q100

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2006

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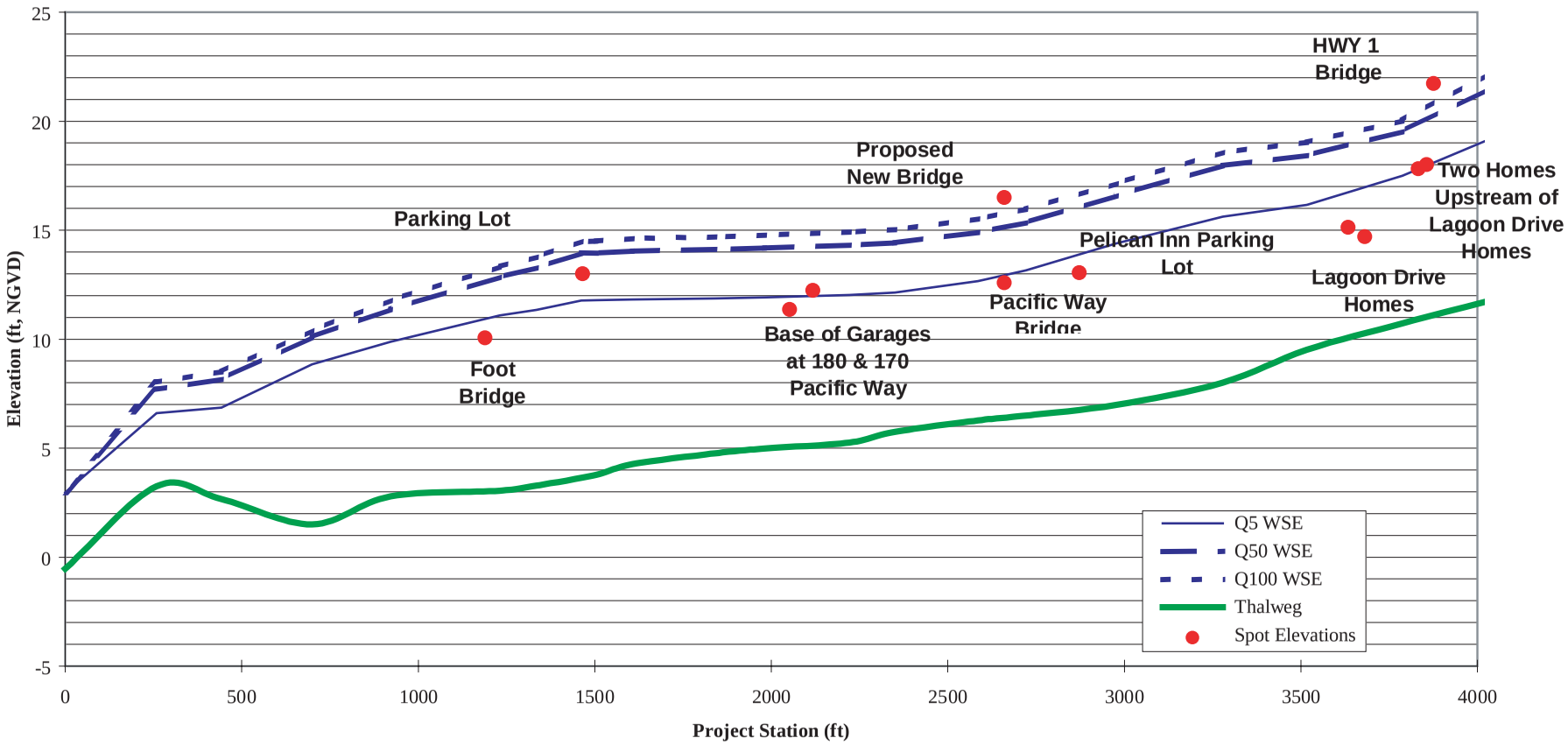
Figure 4.3.1-6
Flooding Scenario, Restoration Alternative 1

Exhibit 2: Final Environmental Impact Statement



Notes: Chainages based on each Alternative 2 MIKE network. Spot elevations based on Alternative 1 MIKE network

Source: PWA 2006

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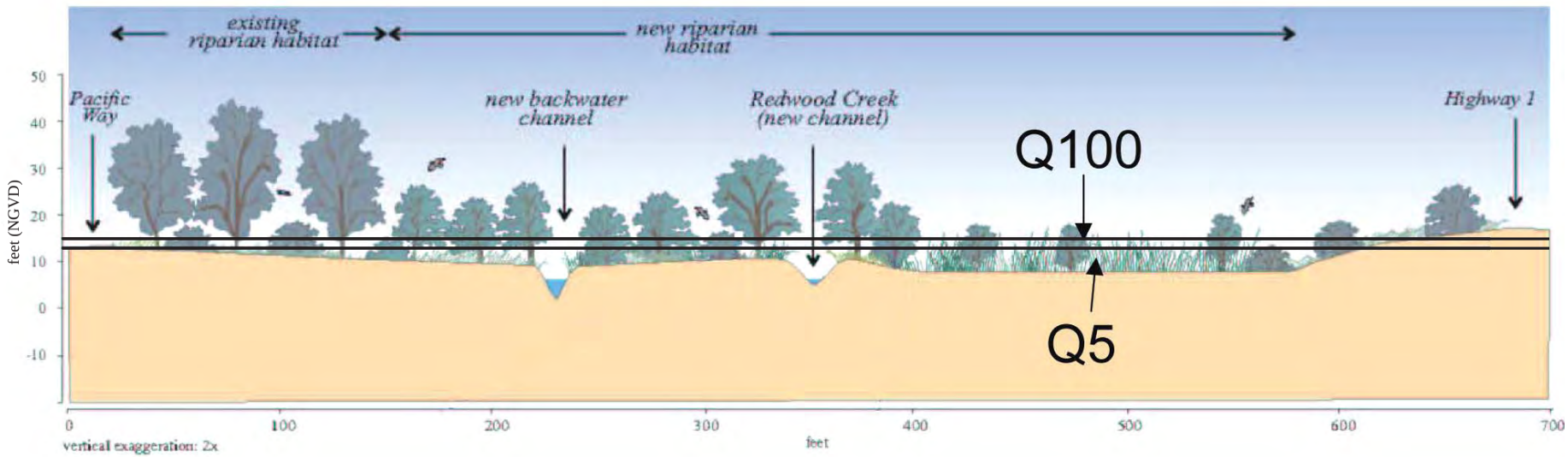
Figure 4.3.1-7
Comparison of Water Levels for Alternative 2 during Q5, Q50, and Q100

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2006

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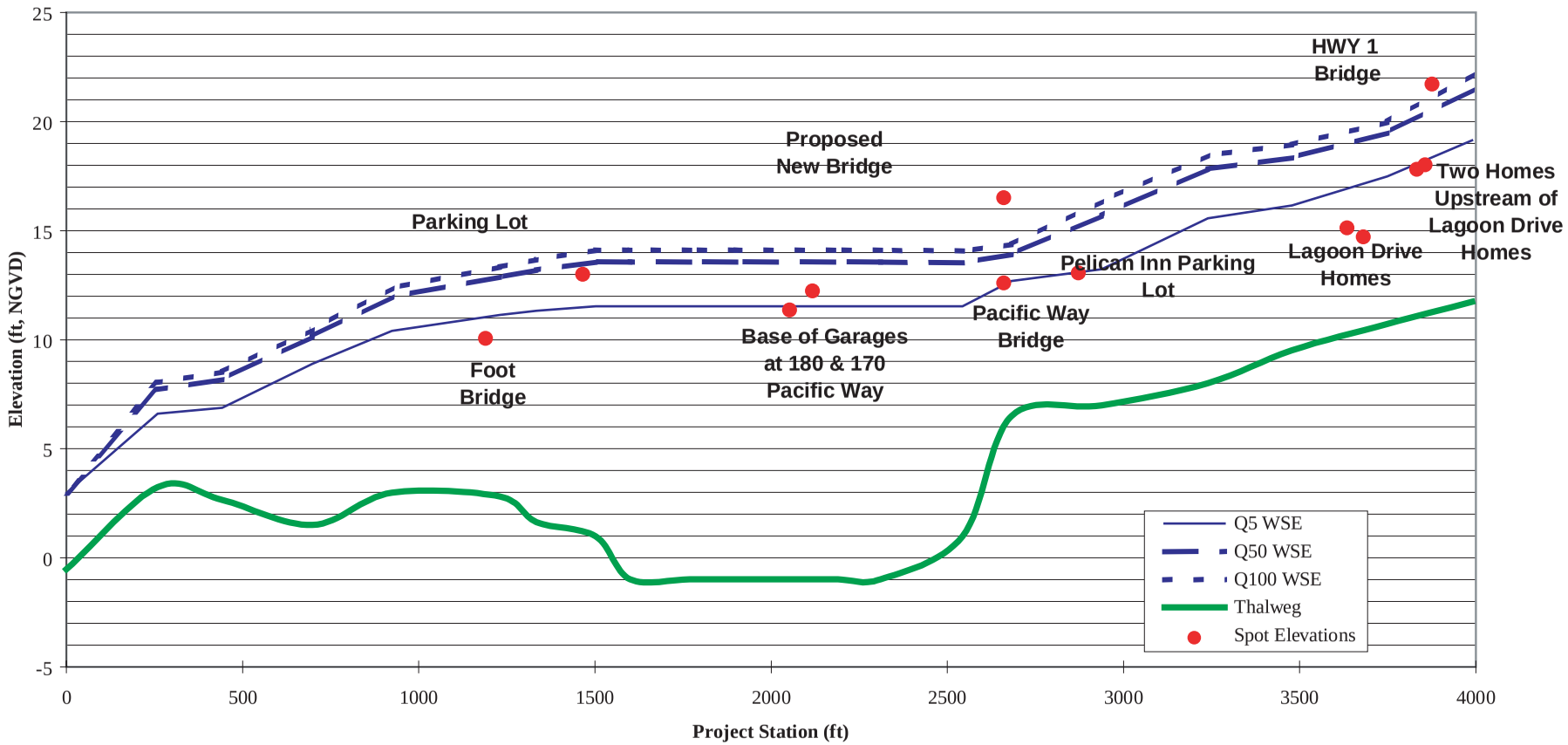
Figure 4.3.1-8
Flooding Scenario, Restoration Alternative 2

Exhibit 2: Final Environmental Impact Statement



Notes: Chainages based on each Alternative 4 MIKE network. Spot elevations based on Alternative 1 MIKE network.

Source: PWA 2006

05052.05 ADEIS/EIR (7-06)

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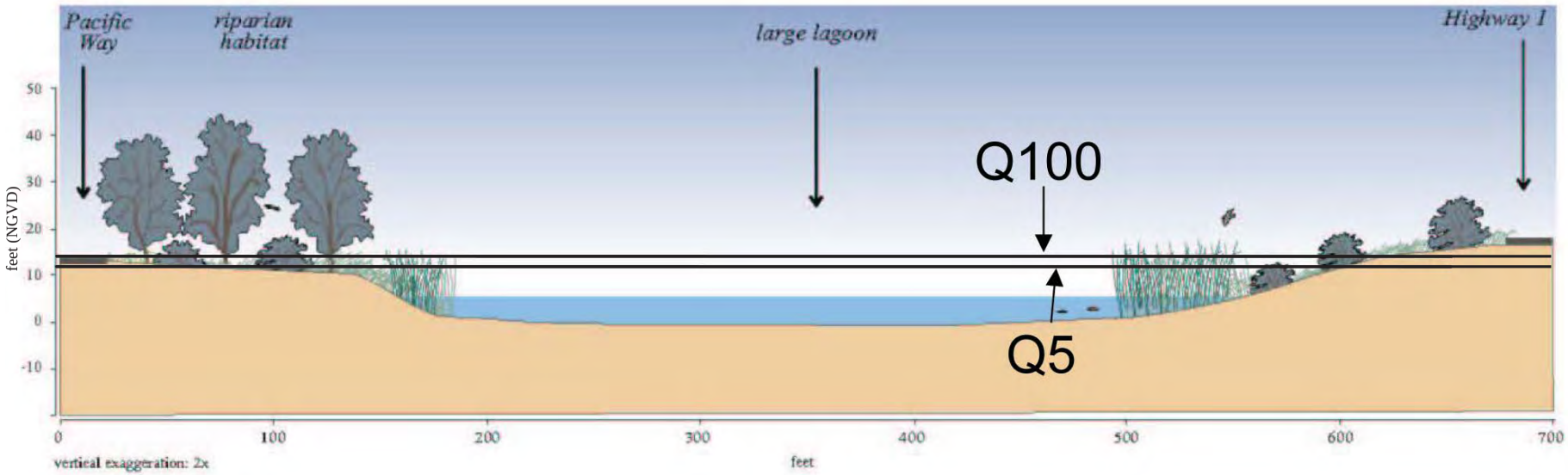
Figure 4.3.1-9
Comparison of Water Levels for Alternative 4 during Q5, Q50, and Q100

Exhibit 2: Final Environmental Impact Statement



Source: PWA 2006

05052.05 EIS/EIR (rev 9-06)

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Figure 4.3.1-10
Flooding Scenario, Restoration Alternative 4

Exhibit 2: Final Environmental Impact Statement

4.3.1.2 Water Quality

Guiding Regulations and Policies

Clean Water Act

Several sections of the 1972 federal Clean Water Act (CWA) regulate impacts on waters of the United States. CWA Section 101 specifies the objectives of CWA implemented largely through CWA Title III (Standards and Enforcement) and CWA Section 301 (Prohibitions). The discharge of dredged or fill material into waters of the United States is subject to permitting specified under CWA Title IV (Permits and Licenses) and specifically under CWA Section 404 of the act (Discharges of Dredged or Fill Material). CWA Section 401 (Certification) specifies additional requirements for permit review, particularly at the state level.

Section 401—Water Quality Certification. Section 401 of the CWA requires that an applicant pursuing a federal permit to conduct any activity that may result in a discharge of a pollutant obtain a Water Quality Certification (or waiver). Water Quality Certifications are issued by RWQCBs in California. Under the CWA, the state (as implemented by the relevant board) must issue or waive Section 401 Water Quality Certification for the project to be permitted under Section 404. Water Quality Certification requires the evaluation of water quality considerations associated with dredging or placement of fill materials into waters of the United States. Implementation of any of the action alternatives would require a 401 Water Quality Certification.

Section 402—National Pollutant Discharge Elimination System Program. The 1972 amendments to the CWA established the National Pollutant Discharge Elimination System (NPDES) permit program to control discharges of pollutants from point sources (Section 402). The 1987 amendments to CWA created a new section of CWA devoted to stormwater permitting (Section 402[p]). The EPA has granted the State of California primacy in administering and enforcing the provisions of CWA and the NPDES Permit Program. The NPDES Permit Program is the primary federal program that regulates point-source and nonpoint-source discharges to waters of the United States.

The SWRCB issues both general and individual permits for certain activities.

Construction Activities. Construction activities are regulated under the NPDES General Permit for Discharges of Storm Water Runoff associated with Construction Activity (General Construction Permit), provided that the total amount of ground disturbance during construction exceeds 1 acre. The San Francisco Bay RWQCB enforces the General Construction Permit. Coverage under a General Construction Permit requires the preparation of a stormwater pollution prevention plan (SWPPP) and submittal of an NOI. The SWPPP includes pollution prevention measures (erosion and sediment control measures and measures to control non-stormwater discharges and hazardous spills), demonstration of compliance with all applicable local and regional erosion and sediment control standards, identification of responsible parties, a detailed

construction timeline, and a best management practices monitoring and maintenance schedule. The NOI includes site-specific information and the certification of compliance with the terms of the General Construction Permit.

Dewatering Activities. Small amounts of construction-related dewatering discharges are covered under the General Construction Permit. Flow diversions are not considered dewatering discharges; however, pumping of groundwater seepage from an excavation and subsequent discharge would be considered a dewatering discharge. For dewatering discharges that do not meet the criteria in the General Construction Permit, the San Francisco Bay RWQCB would need to be consulted and may require that an individual NPDES permit and Waste Discharge Requirement be obtained for dewatering activities. Implementation of any of the action alternatives that involve excavating below subsurface groundwater elevations would be likely to require dewatering.

Porter–Cologne Water Quality Control Act of 1969

The Porter-Cologne Water Quality Control Act established the SWRCB and divided the state into nine regional basins, each with a regional water quality control board. The SWRCB is the primary state agency responsible for protecting the quality of the state's surface and groundwater supplies, while the regional boards are responsible for developing and enforcing water quality objectives and implementation plans.

The act authorizes the SWRCB to enact state policies regarding water quality in accordance with Section 303 of the CWA. In addition, the act authorizes the SWRCB to issue Waste Discharge Requirements (WDRs) for projects that would discharge to state waters. The Porter-Cologne Act requires that the SWRCB or the regional water quality control board adopt water quality control plans (basin plans) for the protection of water quality. A basin plan must:

- identify beneficial uses of water to be protected;
- establish water quality objectives for the reasonable protection of the beneficial uses; and
- establish a program of implementation for achieving the water quality objectives.

Basin plans also provide the technical basis for determining waste discharge requirements, taking enforcement actions, and evaluating clean water grant proposals. The project area is within the jurisdiction of the San Francisco Bay RWQCB. Implementation of any of the action alternatives must be protective of beneficial uses and water quality objectives established in the RWQCB Basin Plan, as described below.

California Regional Water Quality Control Board, San Francisco Bay Region—Basin Plan. Water quality in streams and aquifers of the region is guided and regulated by the San Francisco Bay RWQCB Basin Plan (San Francisco Bay Regional Water Quality Control Board 1995). State policy for water quality control is directed at achieving the highest water quality consistent with the maximum benefit to the people of the state. To develop water quality

standards consistent with the uses of a water body, the RWQCB classifies historical, present, and potential future beneficial uses as part of its basin plan.

Beneficial Uses. The RWQCB Basin Plan identifies the beneficial uses of the San Francisco Bay basin. The beneficial uses established by the Basin Plan for the Redwood Creek watershed (including the project site) are protected against water quality degradation. Beneficial uses for the Redwood Creek watershed include municipal and agricultural supply; recreation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves. The most sensitive beneficial uses from the standpoint of water quality management are municipal supply; recreation; and uses associated with maintenance of resident and anadromous fisheries. A detailed discussion of beneficial uses and water quality objectives can be found in the RWQCB Basin Plan (San Francisco Bay Regional Water Quality Control Board 1995).

Study Area

The area considered for water quality effects includes the Redwood Creek watershed, and the nearshore marine ecosystem in the vicinity of the mouth of Redwood Creek, with particular focus given to the project site (see Figure 1-2).

Analysis Thresholds

- **Negligible:** Alternative would result in no measurable changes in water quality. Additionally, the alternatives would not result alterations in the attainment of beneficial uses.
- **Minor:** Alternative would result in measurable changes in water quality. In the case of adverse impacts, changes would not result in violations of water quality standards, impairment of beneficial uses, or otherwise result in adverse impacts on aquatic species or human health. In the case of beneficial impacts, improvements to water quality may be measurable but would not eliminate violations of water quality standards or existing impairments to beneficial uses.
- **Moderate:** For adverse impacts, violations of water quality standards, impairment of beneficial uses, or other adverse effects would be likely, but would be temporary or short-term in nature. For beneficial impacts, existing violations of water quality standards or impairments to beneficial uses would be alleviated during the duration of impact. No long-term impacts on water quality or long-term trends, either upwards or downwards, would be expected.
- **Major:** For adverse impacts, violations of water quality standards, impairment of beneficial uses, or other adverse effects would be persistent and long-term. Similarly, beneficial impacts would result in long-term improvement and consistently result in increased ability to meet water quality standards and support beneficial uses.

Methods and Assumptions

Existing conditions with respect to water quality have been presented in the Affected Environment chapter. Potential impacts on water quality from the project alternatives were assessed qualitatively, based on available quantitative data and the degree to which the various alternatives could result in violations of water quality standards, impairment of beneficial uses, or water quality conditions that could be harmful to aquatic life or human health, such as acute or chronic toxicity. As described in Chapter 3, *Affected Environment* (Section 3.1.2), water quality data from the project area have been collected from as early as 1986 through the present. The analysis of potential water quality impacts due to implementation of the action alternatives is based on these data and the context of known sources of contaminant loading or other water quality issues in the project area. Seasonality of flows was also considered in evaluating water quality impacts due to potential alterations to contaminant loading or other water quality issues (e.g., temperature, DO).

Construction-related impacts, and associated erosion, have the potential to increase sediment delivery to water bodies, particularly in-channel work such as bridge replacement and creek channel realignment, with resulting adverse effects on turbidity and related parameters such as temperature, pH, and DO. In addition, the potential for the release of construction-related hazardous materials and disturbance of existing on-site hazardous materials was considered. Finally, the potential for excavation below the water table to provide a direct mechanism for contaminants to pollute the aquifer system was evaluated.

Immediately after construction of any of the action alternatives, the loss of vegetation and the associated lack of shade and bare soils may result in temporary increases in temperature and turbidity of surface waters at the site. The potential magnitude of these effects for the action alternatives were evaluated both for the period immediately after construction, and later in the evolution of the site after vegetation has become fully established. Finally, the potential for exposure of previously sequestered nutrients or other contaminants as a result of earthwork, as well as the impaired ability to process and cycle nutrients as vegetation establishes, was considered. All of these factors were used to evaluate the potential for water quality degradation and nuisance aquatic growths and/or eutrophic conditions (i.e., large diurnal DO fluctuations, extreme pH values, and elevated temperatures).

Over the long term, the Restoration Alternatives were evaluated in light of their ability to provide water treatment functions, considering such factors as emergent wetlands and open water systems and their relative ability to process nutrients considering factors such as adsorption and desorption to sediment particles, chemical and photodegradation, biological uptake, and residence time. Wind-generated mixing and related effects on DO levels was also considered. The amount of flushing given seasonal flow variations and extent of standing water were considered in the evaluation of long-term potential for nuisance aquatic growths and/or eutrophic conditions.

For the Public Access, Bridge, and Fill Disposal Alternatives, the potential for non-point source pollution from vehicles and human waste to degrade water quality was considered, including consideration of treatment features such as vegetated strips in the parking lot and compliance with construction permits. Parameters of concern related to these alternatives include petroleum hydrocarbons, heavy metals, nutrients, bacteria, and trash.

In considering these possible alterations to water quality over the long term, the potential for the alternatives to exceed Basin Plan water quality standards or impair beneficial uses of the project area was assessed based on existing data and professional judgment.

Potential effects on biological resources, such as fisheries, due to changes in water quality from the project are discussed in Section 4.3.2, *Biological Resources*. As such, the following discussion evaluates the potential for chemical changes in water quality in relation to established numerical standards.

Restoration Alternatives

Table 4.3.1.2-1 summarizes the potential impacts of Restoration Alternatives to water quality. The Restoration Alternatives are described in Chapter 2.

Table 4.3.1.2-1. Water Quality Impacts from Restoration Alternatives

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
WQ-R1: Release of Construction-Related Sediment from Access Roads, Staging Areas, Ground-Disturbing Activities and Stockpiles	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	WQ-MM-1: Obtain Coverage under General Construction Permit and Implement BMPs
WQ-R2: Release of Construction-Related Hazardous Materials	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	WQ-MM-2: Implement Spill Prevention and Control Plan
WQ-R3: Increased Turbidity in Redwood Creek Following Construction	Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	WQ-MM-3: Implement Turbidity Monitoring and Response Plan
WQ-R4: Increased Nutrients in Redwood Creek Following Construction	Negligible	Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	WQ-MM-4: Implement Water Quality Monitoring and Response Plan
WQ-R5: Increased Water Temperatures in Redwood Creek Following Construction	Negligible	Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	WQ-MM-4: Implement Water Quality Monitoring and Response Plan
WQ-R6: Effects on Nutrients, Dissolved-Oxygen Levels, and Nuisance Plant Growth	Negligible	Minor Beneficial	Moderate Beneficial	Moderate Beneficial	
WQ-R7: Effects on Water Contact Recreation	Negligible	Negligible	Minor Beneficial	Minor Beneficial	
WQ-R8: Salinity Changes in Redwood Creek	Negligible	Negligible	Negligible	Negligible	
WQ-R9: Salinity Changes to groundwater	Negligible	Negligible	Negligible	Negligible	
WQ-R10: Potential for Nuisance Conditions Associated with Mosquito Breeding	Negligible	Moderate Beneficial	Minor Beneficial	Minor Beneficial	

Impact WQ-R1: Release of Construction-Related Sediment from Access Roads, Staging Areas, Ground-Disturbing Activities and Stockpiles (Short-Term, Year 0)

Ground disturbing activities adjacent to surface water bodies, such as regrading of the existing creek channel and adjacent levee road, would present an opportunity for sediment to migrate into the water body through accidental releases. Adverse effects could include increased turbidity and water temperature and reducing DO levels, all of which would potentially exceed water quality

standards and impair beneficial uses. The sediments could also migrate and deposit to downstream areas, resulting in effects within a larger area. Ground disturbance activities for areas larger than 1 acre require compliance with the General Construction Permit, as described above.

Restoration Alternative 1: Moderate Adverse. Periodic maintenance dredging and culvert maintenance could release sediment to surface waters. These construction activities would occur multiple times during the 50-year planning horizon and potentially result in water quality changes that would exceed San Francisco Bay RWQCB thresholds for adverse impacts on beneficial uses of receiving waters; therefore, this impact is considered significant. However, implementation of mitigation measure WQ-MM-1 and compliance with existing NPS policies would reduce this impact below significance thresholds.

Restoration Alternative 2, 3, 4: Moderate Adverse. Impacts of interim flood reduction measures would be similar to those described above for the periodic maintenance dredging under Restoration Alternative 1, although effects would be limited to activities conducted during the years prior to implementation of the restoration project.

As part of the restoration, a large portion of the project site would be subject to ground-disturbing activities during construction. The amount of ground disturbance (excavation) is anticipated to be substantially larger for Alternatives 3 and 4, when compared to Alternative 2 (see Table 2-5). However, the potential for exceedence of water quality standards resulting from potential release of constructed-related sediment would be equally high irrespective of the size of the disturbance area because all the alternatives would alter or be conducted adjacent to existing receiving waters. Therefore, the potential for exceedence of water quality standards and beneficial uses during construction is considered significant for all action alternatives. Implementation of mitigation measure WQ-MM-1 would reduce this impact below significance thresholds.

Impact WQ-R2: Release of Construction-Related Hazardous Materials (Short-Term, Year 0)

As previously discussed, a Phase I hazardous materials investigation indicates that no known sites of contamination are located on the project site. However, hazardous materials associated with construction equipment would be present on-site for the duration of construction of any of the alternatives. Fuel, lubricants, coolants, and other fluids contained with operational equipment are considered hazardous to water resources if accidentally released to surface or ground waters due to poor equipment maintenance or an unforeseeable incident. If these materials are not managed appropriately, long-lasting impairment of water quality, including soils and groundwater, could result as some construction-related materials are highly mobile, persistent, and bioaccumulative in the environment.

Restoration Alternative 1: Moderate Adverse. Periodic dredging and culvert maintenance could release construction-related hazardous materials to receiving waters. These construction activities would occur multiple times during the

50-year planning horizon and potentially result in release of hazardous materials which would violate San Francisco Bay RWQCB thresholds for adverse impacts on beneficial uses of receiving waters; therefore, this impact is considered significant. However, implementation of Mitigation Measure WQ-MM-2 and existing NPS policies would reduce this impact below significance thresholds.

Restoration Alternative 2, 3, 4: Moderate Adverse. Impacts of interim flood reduction measures would be similar to those described above for the periodic maintenance dredging under Restoration Alternative 1, although effects would be limited to activities conducted during the years prior to implementation of the restoration project.

Construction of the restoration project could also lead to releases of fuels, oils, and other construction-related hazardous materials, which could reach surface water or groundwater. As discussed in Chapter 2, the action alternatives would involve excavation below the groundwater table. The new channel for Alternative 2 would be up to 5 feet below the existing surface level, while Alternatives 3 and 4 would involve excavation 10 feet below the existing surface level. Construction activities related to these excavations would present an opportunity for hazardous materials to be released directly to the underlying groundwater aquifer. This could threaten to contaminate the aquifer. Alternatives with deeper excavation below the groundwater table, Alternatives 3 and 4, could have slightly greater potential for aquifer contamination.

Releases of hazardous materials could violate water quality standards or otherwise impair beneficial uses of surface or groundwater. Implementation of Mitigation Measure WQ-MM-2 would reduce this impact below significance thresholds.

Impact WQ-R3: Increased Turbidity in Redwood Creek Following Construction (Short-Term, Years 0 and 5)

Fine suspended matter such as clay, silt, organic matter, plankton, and other microscopic organisms cause water to become turbid. Highly turbid water can alter water temperature, DO concentration, and behavioral and growth patterns of aquatic wildlife. Fish are particularly sensitive to low levels of turbidity over longer periods of time, compared to higher intensity short-duration events, such as peak storm flows (Newcombe and Jensen 1996). Effects of turbidity on fish include reduced visibility and feeding efficiency and territorial behavior, ultimately resulting in reduced growth rates (Berg and Northcote 1985; Newcombe and Jensen 1996).

High levels of turbidity are often the result of construction activities that have occurred within or adjacent to a surface water body, due to migration of sediment from exposed bare soils where vegetation has not become established, or due to material eroded from the substrate of the newly constructed water feature. Sediment inputs to surface waters after project construction can occur in pulses during and after storm events, but that is not always the case as other factors can contribute to sediment input, such as stream bank failure due to fallen trees after a period of high winds. Existing sources of suspended sediment to Redwood

Creek and project site originate from upstream areas, bank erosion, and resuspension of local sediments from tidal mixing, high flows, and wind-generated wave fetch (Philip Williams & Associates 2003). Alterations of turbidity to a degree that would impair beneficial uses related to fish or wildlife resources in the project area compared to existing conditions and after construction would result in an adverse impact.

Restoration Alternative 1: Minor Adverse. Turbidity in Redwood Creek could increase immediately following dredging events; however, these increases would be of short duration (i.e., limited to the first few storm events) and not substantial. Additionally, this alternative would be implemented according to existing NPS management policies, which require implementation of BMPs.

Restoration Alternative 2, 3, 4: Moderate Adverse. Impacts of interim flood reduction measures would be similar to those described above for the periodic maintenance dredging under Restoration Alternative 1, although effects would be limited to activities conducted during the years prior to implementation of the restoration project.

As part of the restoration, areas of bare soil would persist as vegetation establishes following construction of any of the action alternatives, which would result in turbidity in Redwood Creek and the lagoons (as applicable). Pulses of suspended sediment would be expected during storm events occurring in the first rainy season following construction. These short-duration impacts would decrease over time, with conditions expected to return to baseline within about 3 years. As stated above, long-term levels of increased turbidity have a greater adverse impact on fish compared to short-term pulses. Thus, the potential impact of altered turbidity after construction would be significant, but not long-term. However, to ensure newly constructed project elements remain stable and turbidity returns to baseline conditions during the first 5 years after construction (i.e., assure that the project would not create long-term turbidity impacts), implementation of Mitigation Measure WQ-MM-3 would reduce this impact below significance thresholds.

Impact WQ-R4: Increased Nutrients in Redwood Creek Following Construction (Short-Term, Years 0 and 5)

Construction-related activities have the potential to expose previously sequestered nutrients within the streambed and banks, as well as disturb established riparian and aquatic vegetation that sequesters nutrients. This would result in increased nutrients levels in Redwood Creek, potentially resulting in conditions for nuisance algal growth, and consequent fluctuations in DO levels. Any resulting violations of RWQCB water quality objectives for nutrients, DO, or nuisance aquatic growths would result in an impairment of beneficial uses in the project area.

Restoration Alternative 1: Negligible. Periodic maintenance dredging is not anticipated to measurably affect nutrient cycles.

Restoration Alternative 2: Minor Adverse. Interim flood reduction measures are not anticipated to measurably affect nutrient cycles. Under the restoration, realignment of the existing creek channel in Alternative 2 would potentially disturb sequestered nutrients within the soils during excavation activities, and would disturb existing riparian and aquatic vegetation. Because the area of disturbance would be small, the subsequent change to nutrient levels is not anticipated to be substantial, and the potential for violations of water quality objectives is considered less than significant.

Restoration Alternative 3 and 4: Moderate Adverse. Interim flood reduction measures are not anticipated to measurably affect nutrient cycles. Under the restoration, construction of the lagoons under Alternatives 3 and 4 would involve disturbance of a larger area compared to Alternative 2. Therefore, the potential for violations of water quality objectives following construction would be increased under these alternatives. While these impacts are likely to be short-term, to ensure that the restoration actions do not cause violations of water quality standards, implementation of Mitigation Measure WQ-MM-4 is recommended and would reduce this impact below significance thresholds.

Impact WQ-R5: Increased Water Temperatures in Redwood Creek Following Construction (Short-Term, Years 0 and 5)

In general, water temperature is controlled by flow inputs (i.e., springs, rainfall and groundwater inputs) and riparian cover (i.e., shade). Temperature in turn controls chemical processes within the water column, such as DO concentration and plant growth/nutrient cycling. Additionally, habitat requirements for aquatic species are dependent on water temperatures (see discussion in Section 4.4.3, *Fisheries*). While instream flows may be altered to a small extent by the action alternatives, the project site is at the mouth of the Redwood Creek watershed and will only minimally alter the local flow characteristics of the channel (refer to the discussion in Impact WP-R2). Hence, potential increases in stream temperatures are assumed to be the result of local riparian cover densities and the aerial extent of riparian cover. The state water quality standard for temperature is an increase of 5°F (2.8°C) or more above natural receiving water temperature (San Francisco Bay Regional Water Quality Control Board 1995). As stated in Philip Williams & Associates (2003), average water temperatures in the project area range from 11 to 15°C with temperatures reaching as high as 19°C in late summer to early fall.

Restoration Alternative 1: Negligible. Periodic dredging would not substantially affect riparian cover or other factors related to instream temperatures.

Restoration Alternative 2: Minor Adverse. The interim flood reduction measures would not substantially affect riparian cover or other factors related to instream temperatures.

During the first year following restoration, riparian cover would likely be insufficient to provide substantial shade to the newly created channel and could result in slightly increased water temperatures compared to existing conditions,

particularly during low-flow periods such as late summer. This increase could potentially exceed regulatory standards in the first year after construction. This impact would lessen between Years 2–5 and likely match or improve upon current conditions by Year 5 as riparian vegetation matures. To reduce potential impacts to water temperature during the first 5 years of implementation, re-vegetation of the site would include planting of 1–2 year old trees, as opposed to seedlings, to increase the potential for shading over newly restored channels. Alders can grow as much as 20 feet in five years under favorable conditions.

Restoration Alternative 3 and 4: Moderate Adverse. The interim flood reduction measures would not substantially affect riparian cover or other factors related to instream temperatures.

During the first 5–10 years following restoration, tree growth would be insufficient to provide substantial shade to newly created lagoon areas of the project site and could lead to slightly increased water temperatures, particularly during low flow periods such as late summer. It is possible that this increase could exceed regulatory standards (i.e., an increase of 5°F or more), and this impact is considered potentially significant. Implementation of Mitigation Measure WQ-MM-4 would ensure temperatures would remain within regulatory standards over the long term and would reduce impacts below significance thresholds.

Impact WQ-R6: Effects on Nutrients, Dissolved-Oxygen Levels, and Nuisance Plant Growth (Long-Term, Years 5 and 50)

The level of nutrients and DO in a water body, such as creek channels, backwater channels, and lagoons, are influenced by such factors as flow conditions and water temperature. In turn, adjacent vegetation varies depending on water quality condition. For example, water exhibiting high temperature and low flows can reduce DO levels and encourage growth of nuisance algae. Different vegetation types can influence water quality through the varying growth requirements of different plant species. Riparian vegetation, including willows and alders, has a larger influence on water temperature compared to wetland vegetation, which exhibits a larger influence on DO and nutrient levels. Emergent wetlands and backwater channels can encourage nutrient storage, or sequestering. Winds affect water circulation and influences nutrient and DO cycling. Violations of standards for nutrients, pH, DO, temperature, or narrative water quality standards would be considered a significant impact on water quality.

Restoration Alternative 1: Negligible. Periodic maintenance dredging is not anticipated to measurably affect nutrient cycles, dissolved-oxygen levels or nuisance plant growth.

Restoration Alternative 2: Minor Beneficial. The interim flood reduction measures are not anticipated to measurably affect nutrient cycles, dissolved-oxygen levels or nuisance plant growth.

Under the restoration, the extent of wetlands is anticipated to be less for Alternative 2 when compared to existing conditions. Thus, there would be a

slightly greater potential for reduced nutrient sequestration and adverse water quality conditions, such as low dissolved-oxygen levels and nuisance growths, particularly during low flow periods in late summer. This condition would be especially evident in the backwater channels. Over time, the backwater channels would experience low flushing rates and may transition to emergent wetlands if they became isolated features, which would concentrate nutrients and increase the potential for formation of eutrophic conditions. However, the influence of these features is minor in comparison to that in the main creek channel and lagoon and thus is not anticipated to result in overall degradation of water quality in the project area. A dense riparian forest over-story would develop over the main channel by Year 50. The increased shade over the channel would help to maintain cool water temperature and moderate oxygen and temperature extremes (Philip Williams & Associates 2004).

Restoration Alternative 3: Moderate Beneficial. The interim flood reduction measures are not anticipated to measurably affect nutrient cycles, dissolved-oxygen levels or nuisance plant growth.

Under the restoration, the potential for slightly reduced dry season flows in Redwood Creek as described in Impact WP-R2 could result in slightly reduced flushing and degraded water quality. However, this is anticipated to be a minimal effect. In addition, as soils and vegetation develop in the lagoons, their ability to sequester nutrients would increase, with decreased potential for nuisance plant growths and low dissolved-oxygen levels. Over time, the lagoons would fill in, and open water areas would transition to emergent wetlands, with corresponding increases in treatment functions.

During later stages of wetland development, low flushing rates due to the off-channel orientation of the lagoons could result in buildup of nutrients in the system and reduced ability to process nutrient inputs, with increased potential for eutrophic conditions. Reduced wind mixing as the extent of open water areas decreases would also contribute to potential for increased temperatures, lower dissolved-oxygen levels, and eutrophic conditions.

However, overall water quality conditions are anticipated to be improved due to the increased water treatment functions associated with the lagoons. Periodic maintenance of the lagoons (e.g., removal of vegetation and accumulated sediment) may be desirable to maintain optimal treatment functions**.**

Restoration Alternative 4: Moderate Beneficial. Impacts would be similar to Alternative 3; however, the increased flushing due to the on-channel orientation of the lagoon, and increased wind mixing from the larger area of open water, would result in additional benefits to water quality conditions compared to Alternative 3.

Impact WQ-R7: Effects on Water Contact Recreation (Long-Term, Years 5 and 50)

Water contact recreation is a protected beneficial use of waters of the state. Though risks to human health are covered in Section 4.3.4.5, *Human Health and*

Safety, this discussion addresses the potential impact to human health, through water-related recreational activities, that are caused by waterborne illnesses. The primary water quality concern related to recreational uses is related to existing sources of bacteriological contamination.

Restoration Alternative 1: Negligible. Conditions related to elevated bacteria in lower Redwood Creek and the nearshore area of the Pacific Ocean would persist. Temporary beach closures would continue to occur.

Restoration Alternative 2: Negligible. Conditions are anticipated to be substantively similar to Alternative 1.

Restoration Alternative 3, 4: Minor Beneficial. The treatment functions of the lagoon(s) could result in a marginal decrease in bacteria counts in lower Redwood Creek and the Pacific Ocean. However, it is unlikely that treatment would be sufficient to substantially decrease the frequency of exceedances of regulatory standards.

Impact WQ-R8: Salinity Changes in Redwood Creek (Long-Term, Years 5 and 50)

Temperature, DO, and nutrients levels are influenced by the salinity of the water. Coastal areas are influenced by oceanic tidal actions that carry influxes of high salinity waters to surface waters. Coastal streams, such as Redwood Creek, discharge freshwater to the ocean at the creek's mouth. The location of the interface between fresh and saltier water is dependent on seasonal freshwater flows and tidal actions. High salinity ocean waters are characteristically colder, contain a lower concentration of DO compared to freshwater, and are more dense, sinking to form a saline layer beneath freshwater.

Restoration Alternative 1, 2: Negligible. The tidal influence would continue to extend to the approximate location of the existing footbridge.

Restoration Alternative 3, 4: Negligible. The lagoons in each alternative would be upstream of tidal influence, although large spring tides could result in overwash from wave action into the lagoons, raising salinity in the lagoons on an infrequent seasonal basis. This would be flushed by inflows, which are anticipated to be relatively high during these periods, although stratification based on salinity may persist in backwater areas, and cells of saline water may be found at deeper locations within the lagoons. Because this is a natural characteristic of similar coastal lagoons and was likely the case in the historic Big Lagoon, it is not considered an adverse effect.

Impact WQ-R9: Salinity Changes to Groundwater (Long-Term, Years 5 and 50)

Groundwater basins adjacent to saline areas, such as the ocean, can be subject to saltwater intrusion as a result of infiltration through the pore space in the aquifer. This typically occurs when water levels in the freshwater aquifer reduce to an extent that saline water intrudes. This condition can change a primarily

freshwater basin to a saline one, thus making the water difficult to utilize for human consumption.

On the project site, groundwater levels are fundamentally set by the channel thalweg in the lower portion of the project site near the ocean. Because the thalweg is currently above the tidal range, it presents an effective barrier to saltwater intrusion. While the Restoration Alternatives would reduce the thalweg in this reach by up to one foot, it would still be at or above the tidal range, as would the bottoms of the lagoons.

As a further line of evidence, groundwater elevations would be similar to those 10–20 years ago, and saltwater intrusion did not appear to occur.

Finally, although sea level rise could theoretically affect the extent of inland migration of saltwater, this is not anticipated to occur due to the fact that sediment deposition (and channel thalweg elevations) is expected to outpace the rate of sea level rise for all alternatives.

Restoration Alternative 1, 2, 3, 4: Negligible. Based on the analysis conducted by PWA (2004), lowered groundwater elevations would exist under all alternatives. To simulate the worst-case condition, where channel incision resulting from excavation and aggraded sediment flushing upstream of the bridge occurs, groundwater surface lowering by 3 feet from the upstream end of the large lagoon under Alternative 4, transitioning to 1 foot at the Hwy 1 bridge and upstream was evaluated (Philip Williams & Associates 2004). The analysis concluded that the cone of groundwater depression would not extend downstream of the existing footbridge, and the natural barrier between fresh and saline water would not be altered. The potential for saltwater intrusion into the aquifer would be minimal and the potential for groundwater to become saline as a result of seasonal tidal influxes of saline surface water is not anticipated to be to a degree which would significantly alter the salinity of the groundwater.

Impact WQ-R10: Potential for Nuisance Conditions Associated with Mosquito Breeding (Long-Term, Years 5 and 50)

The potential human health impact of increased mosquito breeding is discussed in Section 4.6.5, *Human Health and Safety*. This impact discusses the impact on recreational beneficial uses of the project site. The threshold of significance for beneficial use impairment of contact and non-contact recreational activities is an increase in nuisance conditions to a degree in which aesthetic enjoyment of the project site would be reduced. As discussed in Section 4.6.5, mosquito breeding tends to occur within emergent wetland areas and stagnant or slow-moving open waters.

Restoration Alternative 1: Negligible. The extent of standing water would be similar to existing conditions and would not lead to increases in mosquito breeding habitat or reduced aesthetic enjoyment.

Restoration Alternative 2: Moderate Beneficial. The combined extent of emergent wetland and open water systems would be greatly reduced, and the

amount of low-velocity areas allowing mosquito breeding would be decreased. The backwater feature under this alternative could still require mosquito abatement activities during low-flow periods. However, Alternative 2 would reduce emergent wetland and open water areas compared to existing conditions. Thus, implementation of Alterative 2 would result in a potentially beneficial impact to recreational beneficial uses.

Restoration Alternative 3: Minor Beneficial. Although the combined extent of emergent wetland and open water area would decrease, especially by Year 50, the backwater lagoons would have low-velocity wetland marsh areas that would be amenable to mosquito breeding. The connectivity of these features to the Redwood Creek channel would allow for predation by fish on mosquito larvae; however, these features could be isolated from the main channel, as described in Impact HYD-R4. During the summer low-flow period, stagnant water within the emergent wetland areas would provide breeding habitat for mosquitoes, thus requiring mosquito abatement actions. Nonetheless, since this alternative would reduce the extent of breeding habitat compared to existing conditions, there would be a beneficial effect on recreational uses of the project site.

Restoration Alternative 4: Minor Beneficial. As with Alternative 3, the combined extent of open water and wetland systems, which provide breeding habitat, would be reduced compared to existing conditions. Additionally, the on-channel orientation of the large lagoon would allow for improved flushing and fish predation on larvae, further reducing the potential for nuisance conditions. During the summer low-flow period, stagnant water within the emergent wetland and open water areas would provide breeding habitat for mosquitoes, thus requiring mosquito abatement actions. However, the potential for this alternative to have a significant effect on recreational uses of the site would be reduced compared to existing conditions.

Public Access Alternatives

Table 4.3.1.2-2 summarizes the potential impacts of Public Access Alternatives to water quality. The Public Access Alternatives are described in Chapter 2.

Table 4.3.1.2-2. Water Quality Impacts from Public Access Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							
Impact	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	Mitigation Measure
WQ-P1: Release of Construction-Related Sediment From Construction of Public Access Features	Negligible	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	WQ-MM-1: Obtain Coverage Under General Construction Permit and Implement BMPs
WQ-P2: Release of Construction-Related Hazardous Materials	Negligible	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	WQ-MM-2: Implement Spill Prevention and Control Plan
WQ-P3: Non-Point Source Runoff from Public Access Features	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	

Impact WQ-P1: Release of Construction-Related Sediment from Construction Of Public Access Features (Short-Term, Year 0)

Impact mechanisms would be as described under Impact WQ-R1.

Public Access Alternative A: Negligible. No construction with potential to release sediment would occur.

Public Access Alternative B1–B5, C: Moderate Adverse. Construction of public access features would involve ground-disturbing activities. The amount of ground disturbance would differ somewhat between alternatives in relation to parking lot size. This impact is considered potentially significant. Implementation of Mitigation Measure WQ-MM-1 will ensure water quality is adequately protected and impacts are reduced below significance thresholds.

Impact WQ-P2: Release of Construction-Related Hazardous Materials (Short-Term, Year 0)

Impact mechanisms would be as described under Impact WQ-R2.

Public Access Alternative A: Negligible. No construction with potential to release hazardous materials would occur.

Public Access Alternative B1–B5, C: Moderate Adverse. Construction could lead to releases of fuels, oils, and other construction-related hazardous materials, which could reach surface or groundwater. This is considered a potentially

significant impact. Implementation of Mitigation Measure WQ-MM-2 would reduce this impact below significance thresholds.

Impact WQ-P3: Non-Point Source Runoff from Public Access Features (Long-Term, Years 5 and 50)

Storm runoff from impervious surfaces can carry trash, car pollution (e.g., leaking oil), and sediment to adjacent water bodies. Runoff from impervious surfaces can also increase erosion of soils at runoff discharge locations due to increased erosive force of the water as it gains velocity flowing across the impervious surface. The RWQCB regulates non-point sources of pollution through enforcement of established water quality standards. Installation of BMPs, such as filtration devices and velocity reducing designs, can alleviate impacts from non-point source pollution.

Public Access Alternative A: Negligible. Existing public access features would continue to present potential for non-point source pollution.

Public Access Alternative B1–B5, C: Minor Beneficial. Park visitation would continue to result in non-point source pollution, such as trash, human wastes, and pollution from cars; however, the installation of vegetated strips in the parking lot would provide water quality treatment functions. Alternatives with smaller parking lot capacities would also reduce vehicle-related non-point source pollution to some small extent.

Bridge Alternatives

Table 4.3.1.2-3 summarizes the potential impacts of Bridge Alternatives to water and sediment quality in the study area. The Bridge Alternatives are described in Chapter 2.

Table 4.3.1.2-3. Water Quality Impacts from Bridge Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	Mitigation Measure
WQ-B1: Release of Construction-Related Sediment from Construction of Bridge Alternatives	Negligible	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	WQ-MM-1: Obtain Coverage Under General Construction Permit and Implement BMPs
WQ-B2: Release of Construction-Related Hazardous Materials	Negligible	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	WQ-MM-2: Implement Spill Prevention and Control Plan

Impact WQ-B1: Release of Construction-Related Sediment from Construction Of Bridge Alternatives (Short-Term, Year 0)

Impact mechanisms would be as described under Impact WQ-R1.

Bridge Alternative BR0: Negligible. No construction with potential to release sediment would occur.

Bridge Alternatives BR1-BR4: Moderate Adverse. Construction of the new bridge would involve ground-disturbing activities under all alternatives. The amount of ground disturbance is not anticipated to differ substantially between alternatives, although it may change somewhat in relation to bridge footprint and required fill amounts. This impact is considered potentially significant. Implementation of Mitigation Measure WQ-MM-1 will ensure water quality is adequately protected and impacts are reduced below significance thresholds.

Impact WQ-B2: Release of Construction-Related Hazardous Materials (Short-Term, Year 0)

Impact mechanisms would be as described under Impact WQ-R2.

Bridge Alternative BR0: Negligible. No construction with potential to release hazardous materials would occur.

Bridge Alternatives BR1-BR4: Moderate Adverse. Construction could lead to releases of fuels, oils, and other construction-related hazardous materials, which could reach surface or groundwater. This is considered a potentially significant impact. Implementation of Mitigation Measure WQ-MM-2 would reduce this impact below significance thresholds.

Fill Disposal Alternatives

Table 4.3.1.2-4 summarizes the potential impacts of Fill Disposal Alternatives to water quality in the study area. The Fill Disposal Alternatives are described in Chapter 2.

Table 4.3.1.2-4. Water Quality Impacts from Fill Disposal Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail*	Mitigation Measure
WQ-F1: Release of Construction-Related Sediment During Fill Disposal Activities	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	WQ-MM-1: Obtain Coverage Under General Construction Permit and Implement BMPs
WQ-F2: Release of Construction-Related Hazardous Materials During Fill Disposal Activities	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	WQ-MM-2: Implement Spill Prevention and Control Plan

Note:

* The analysis of the two trail alternatives only considers the effects of hauling the fill to the sites. For the coastal trail, impacts of using the fill to recontour the trail are also considered.

Impact WQ-F1: Release of Construction-Related Sediment from Fill Disposal (Short-Term, Year 0)

Impact mechanisms would be as described under Impact WQ-R1.

All Alternatives: Moderate Adverse. Fill disposal activities would involve placement of fill that could erode and reach surface waters. In addition, construction or improvements to access roads would involve ground-disturbing activities under all alternatives. This would be particularly the case for the Banducci Field, which would require fill and a culvert along an intermittent tributary to Redwood Creek. This impact is considered potentially significant. Implementation of Mitigation Measure WQ-MM-1 will ensure water quality is adequately protected and impacts are reduced below significance thresholds.

Impact WQ-F~~B~~2: Release of Construction-Related Hazardous Materials During Fill Disposal Activities (Short-Term, Year 0)

Impact mechanisms would be as described under Impact WQ-R2.

All Alternatives: Moderate Adverse. Equipment used for fill disposal use fuels, oils, and other construction-related hazardous materials, an accidental release of which could reach surface or groundwater. This is considered a potentially significant impact. Implementation of Mitigation Measure WQ-MM-2 would reduce this impact below significance thresholds.

Mitigation Measures

WQ-MM-1: Obtain Coverage Under the General Construction Permit and Implement Best Management Practices

Prior to onset of construction activities, NPS, the County, and/or its contractors will obtain coverage under the NPDES General Construction Permit. As part of this process, a SWPPP will be prepared and BMPs identified in the SWPPP will be implemented to control soil erosion, in-channel turbidity, and discharges of other construction-related contaminants such as fuel, oil, grease, paint, concrete, and other hazardous materials. Routine monitoring and inspection of BMPs will be conducted to ensure that the quality of stormwater discharges is in compliance with the permit. Flows in the creek or wetland areas will be diverted around the active construction area, and ground-disturbing activities will be limited to the dry weather season to the extent possible.

The SWPPP will be prepared prior to the start of construction activities and prescribe site-specific implementation of BMPs to avoid and reduce waste discharges. The SWPPP will include BMPs that address the following general categories of erosion and runoff control:

- conduct construction activities during the dry season to the extent possible;
- conduct all construction work in accordance with site specific construction plans that minimize the potential for increased delivery of sediment to surface waters;
- tracking control measures to reduce sediments that leave the construction site on vehicle or equipment tires;
- cover all loads to reduce the potential for loss of materials during transit;
- ensure that concentrated runoff and concentrated discharge are diverted away from channel banks;
- minimize removal of and damage to native vegetation;
- install temporary construction fencing to identify all areas that require clearing, grading, revegetation, or recontouring, and minimize the extent of areas to be cleared, graded, recontoured, or otherwise disturbed;
- grade and stabilize or cover spoils sites to minimize erosion and sediment input to surface waters and generation of fugitive dust;
- routinely water dust-prone construction areas to reduce generation of fugitive dust and to control migration of sediment outside of the project area on construction vehicle tread;
- as appropriate, implement erosion and sediment control measures to prevent sediment from entering surface waters, including the use of willow wattles to trap sediments and erosion control blankets on slopes and channel banks;
- avoid operating equipment in flowing water by using temporary cofferdams and water diversion systems to divert flow around the channel and bank construction area; and

- monitor water quality of dewatering operations and hazardous material delivery, storage, and emergency spill response requirements.

As a performance standard, the BMPs shall represent the best available technology that is economically achievable and shall be selected to achieve maximum sediment removal. The contractor will select specific BMPs from each area, with NPS/County approval, on a site-specific basis. The construction contractor will ensure that the BMPs are implemented as appropriate throughout the duration of construction and will be responsible for subcontractor compliance with the SWPPP requirements.

In the case of ground-disturbing activities that are of less than one acre in extent (e.g., possibly the routine maintenance dredging activities), coverage under the General Construction Permit will not be required, but NPS, the County and/or its contractors shall still be required to adhere to the BMPs and standards identified above.

WQ-MM-2: Implement Spill Prevention and Control Plan

As part of the obtaining coverage under the NPDES General Construction Permit, the NPS and/or its contractors will develop and implement a spill prevention and control program to minimize the potential for, and effects from, spills of hazardous, toxic, or petroleum substances during construction of the project. The plan will be completed before any construction activities begin and shall include provisions for preventing, containing, and reporting spills of hazardous materials. If a spill is reportable, the contractor's superintendent would notify the Marin County Department of Emergency Services and the California Department of Toxic Substances Control (DTSC).

WQ-MM-3: Implement Turbidity Monitoring and Response Plan

NPS or its contractors will develop and implement a plan to monitor turbidity resulting from the restoration project. This will involve review of existing monitoring data and collection of turbidity measurements within the project site prior to the restoration activity, both during and immediately following storm events as well as during the dry season, to establish background turbidity levels. Following construction of the project, turbidity monitoring will be conducted as outlined above for up to 5 years, or until monitoring results indicate that turbidity has returned to background levels. Should elevated turbidity persist after the first three years following construction, specific areas on the restored site that are contributing to elevated sediment inputs will be identified, and these locations will be repaired by installing erosion control BMPs. As a performance standard, the BMPs shall represent the best available technology that is economically achievable and shall be selected to achieve maximum sediment removal.

WQ-MM-4: Implement Water Quality Monitoring and Response Plan

NPS or its contractors will develop and implement a plan to monitor water quality resulting from the restoration project. Previously collected water quality measurements within the project site and upstream in the watershed will be used as the basis for baseline conditions. Similar sampling methodologies will be implemented after project construction, such as collection of samples

immediately following storm events and during the dry season. Parameters to be evaluated will include, at a minimum, temperature, pH, DO, total dissolved solids/electrical conductivity, total suspended solids, nutrients, and bacteria.

On the basis of this sampling, water quality conditions will be evaluated to determine whether applicable water quality standards have been exceeded or beneficial uses have been impaired for a sustained period (i.e., greater than 2 years) as a result of the restoration project, such as through excessive nuisance plant growth in the restored lagoons resulting in alterations of water temperature, low DO levels, and excessive nutrient levels. Hydrologic conditions and nutrient cycling at the project site will differ from existing conditions and thus require time to adjust to a new naturally functioning condition. Consequently, the thresholds may change to reflect different stages of project establishment.

Violations of water quality standards or impairments of beneficial uses as a result of the project shall be ameliorated through implementation of BMPs or other adaptive management actions as needed. Should long-term monitoring (greater than 5 years of consecutive data) indicate that the project is not having an adverse effect on water quality, monitoring may be ceased.

4.3.1.3 Water Supply

Guiding Regulations and Policies

Surface Water Rights

The SWRCB administers surface water rights in the State of California. In general, two types of surface water rights are recognized: riparian water rights and appropriative water rights.

Riparian Water Rights. Riparian water rights are entitlements to water that are held by owners of land bordering natural flows of water. A landowner has the right to divert a portion of the natural flow for reasonable and beneficial use on his/her land in the same watershed. If natural flows are not sufficient to meet reasonable beneficial requirements of all riparian users on a stream, the users must share the available supply according to each owner's reasonable requirements and uses. Natural flows do not include return flows from use of groundwater (e.g., for irrigation), water seasonally stored and later released (e.g., in reservoirs), or water diverted from another watershed.

Appropriative Water Rights. Appropriative water rights are entitlements to water that are held by users of water where the water is used on land that does not border the natural flow of water. Unlike riparian rights, an appropriative right carries a priority relative to other appropriative rights. The water user who is first to file for the water right is entitled to the full quantity of water specified under the right before junior appropriators may exercise their rights. All new appropriators must file an application with the SWRCB and obtain a permit before diverting water. In granting permits, the SWRCB determines whether the water will be put to beneficial use, how much water may be taken, when and where the water can be taken, and necessary conditions to protect the environment, the public trust, and prior rights. If the water is diverted and applied to beneficial use in accordance with the terms of the permit for a period of years, a license may be issued confirming the extent of the permittee right.

California Water Code sections 1700–1705 govern changes in appropriative water rights acquired under division 2 of the California Water Code. The code requires that any change to an existing water right, including a change in the place of use, type of use, point of diversion, or location of storage, be reviewed by the SWRCB. Section 1702 codifies the no injury rule that an appropriator can make a change in its water right as long as the change is not injurious to other water rights holders. The changes are subject to CEQA, and the SWRCB has an affirmative duty to take the public trust into account. The SWRCB must ensure compliance with environmental review requirements before making a decision. Pursuant to CEQA, the level and intensity of environmental evaluation are determined on a case-by-case basis.

Groundwater Rights

Overlying property rights allow anyone in California to build a well and extract a correlative share of groundwater. The share to which the property owner is

entitled is generally not defined. Unlike surface water rights, groundwater rights are based on overlying use and are not subject to the appropriative rights process of the SWRCB, except in special circumstances. One such circumstance is where the groundwater in question is determined to be underflow to a surface water body, such as the MBCSD well upstream of the project site. In these cases, the groundwater use is treated as a surface diversion and is subject to the same riparian and appropriate water rights processes as described above for surface diversions.

Study Area

Water supply was considered in the context of the entire Redwood Creek watershed; however, because of the limited spatial effect of the project on water supply, the study area was limited to the project site and upstream area extending to the MSCSD well.

Analysis Thresholds

The following thresholds were used in determining impacts on water supply.

- **Negligible:** Alternative would result in no measurable changes in the ability of the MBCSD or other legal water users to extract water.
- **Minor:** Alternative would result in measurable changes in the ability of MBCSD or other legal water users to extract water but would not increase or decrease pumping costs or change the total quantity available for extraction such that it would affect the annual amount of water extraction.
- **Moderate:** Alternative would result in changes in the ability of MBCSD or other legal water users to extract water that would alter pumping costs or the total quantity of water available for extraction on a seasonal or temporary basis.
- **Major:** Alternative would result in changes in the ability of MBCSD or other legal water users to extract water that would result in permanent long-term changes in pumping costs or the quantity of water available.

Methods and Assumptions

The analysis assumes that existing appropriative rights on the project site would be acquired by NPS or otherwise abandoned prior to project implementation. Because the project site does not serve as an active source of surface or groundwater supply for diversions, the analysis focuses on the effects that the alternatives could have on the supply of water available for groundwater withdrawals off-site. The effects of upstream water diversion on flows entering the site are addressed in the low flow hydrology discussion in Section 4.3.1.1, *Watershed Processes*.

The methodology for evaluation of effects of the alternatives on groundwater levels is described in the *Addendum to the Feasibility Analysis Report* (Philip Williams & Associates 2004) and is based on results from a computer model of groundwater and surface water dynamics derived from existing and historical topographic and hydrologic conditions at the project site. Impacts to the MSCSD well upstream of the project site in particular were considered. The addendum considered the following issues.

- Changes in the physical system at the project site.
- Effects of changes in the physical system on groundwater levels.
- Potential for associated changes to groundwater levels off site.
- Absolute quantity of water supply.

In addition, NPS does not provide running water at Muir Beach and does not have any surface water diversions at the project site. This situation would not change under any of the action alternatives, which do not propose site improvements involving running water, such as flush toilets or drinking water fountains. The nonflushing (pit) toilets that are proposed to be replaced by vault toilets at Muir Beach do not require use of running water. Therefore, the potential effects of park-related consumptive use at Muir Beach are not considered further.

Restoration Alternatives

Table 4.3.1.3-1 summarizes the potential impacts of Restoration Alternatives on water supply in the study area. The Restoration Alternatives are described in Chapter 2.

Table 4.3.1.3-1. Water Supply Impacts from Restoration Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				
Impact	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	Mitigation Measure
WS-R1: Potential Reductions in Groundwater Levels at the Muir Beach Community Services District Well near Redwood Creek	Negligible	Negligible	Negligible	Negligible	
WS-R2: Potential Reductions in Groundwater Levels at the Green Gulch Farm Well near Green Gulch Creek	Negligible	Negligible	Negligible	Negligible	
WS-R3: Potential Effects on SFZC Appropriative Water Right	Negligible	Negligible	Negligible	Negligible	

Impact WS-R1: Potential Reductions in Groundwater Levels at the Muir Beach Community Services District Well near Redwood Creek (Long-Term, Years 5 and 50)

When the thalweg of a creek channel is lowered, for example when erosive forces cause a channel to downcut, the level of the surrounding water table also

lowers as a result of the changed conditions. Adverse effects of a lowered water table to nearby water supply wells potentially include increased pumping costs and a need to drill the well deeper. In extreme cases, the water table is lowered to an extent that it becomes inaccessible to wells, or sufficient volume in the aquifer no longer exists to support the well.

Restoration Alternative 1: Negligible. No actions would be taken that would change groundwater levels and adversely affect the MBCSD well. Periodic maintenance dredging is anticipated to only have localized, short-term impacts to groundwater levels that would be restricted to the project site.

Restoration Alternatives 2, 3, 4: Negligible. Changes in groundwater levels as a result of the action alternatives have been described under Impact WP-R1. The reduction in groundwater would be approximately 1 foot under Restoration Alternative 2. Restoration Alternative 4 would have the greatest effect on groundwater levels, and analysis conducted by Philip Williams & Associates (2005) indicates that the maximum change to groundwater levels under a worst-case scenario, including drought conditions, from Restoration Alternative 4 would be:

- Lowered 1 foot downstream of the large lagoon to the beach;
- Lowered 4 feet (to elevation +3 feet NGVD) at the large lagoon area;
- Lowered 3 feet from the upstream end of the large lagoon, transitioning to 1 foot at the Hwy 1 Bridge and upstream (assuming “worst-case” channel incision resulting from the project);
- Lowered 3 feet along Green Gulch Creek and the unnamed tributary in the large lagoon site; and
- Transitioned to zero at existing grade control structures.

Restoration Alternative 3 would have a similar decrease in groundwater levels but to a lesser extent. Under all alternatives, the zone of influence of water table lowering is expected to be roughly within the project limits.

The MBCSD well is approximately 1 mile upstream of the project site. Therefore, the potential for an adverse effect on the MBCSD well is considered remote.

Impact WS-R2: Potential Reductions in Groundwater Levels at the Green Gulch Farm Well near Green Gulch Creek (Long-Term, Years 5 and 50)

Impact mechanisms would be the same as described above under Impact WS-R1.

Restoration Alternative 1: Negligible. No actions would be taken that would change groundwater levels and adversely affect the Green Gulch Farm well. Periodic maintenance dredging is anticipated to have only localized, short-term impacts to groundwater levels that would be restricted to the project site.

Restoration Alternatives 2, 3, 4: Negligible. As described above, under the worst-case scenario (Restoration Alternative 4) for Impact WS-R1, groundwater levels would be lowered up to 3 feet along Green Gulch Creek in the large lagoon site, transitioning to zero at existing grade control structures (i.e., the concrete lining in the creek). The Green Gulch Farm well is located upstream of the grade control structure, approximately 150 feet from Green Gulch Creek, outside the zone of influence. Therefore, the potential for an adverse effect on the Green Gulch Farm well, which is used only for backup supply, is considered very low. Even if groundwater drawdown extended further upstream, it would not be expected to affect the much lower depth of the groundwater well.

Impact WS-R3: Potential Effects on SFZC Appropriative Water Right (Long-Term, Years 5 and 50)

The SFZC has an appropriative water right to divert up to 47 acre-feet from Redwood Creek annually within the project site. This diversion has not been used since 1989, and the location of the diversion is prone to periodic pulses of salt water from tidal inflows. As part of the project, NPS and SFZC will make an agreement to have the right abandoned in fact or in effect ~~or else NPS will acquire the right~~. As such, this is not anticipated to have an adverse effect on SFZC's water right or on future ecological uses of the site.

Restoration Alternative 1: Negligible. No actions would be taken that would affect the water right.

Restoration Alternatives 2, 3, 4: Negligible. See discussion above.

Public Access Alternatives

The Public Access Alternatives would not involve any activities that could affect water supply. The impacts of the Public Access Alternatives to water supply are not discussed further.

Bridge Alternatives

The potential for disruption of water supply as a result of the need to relocate MSCSD water lines on the project site is discussed in Section 4.3.4.4, *Energy, Public Services, Utilities, and Service Systems*, under Impact PS-R4. The Bridge Alternatives would not involve other activities that could affect water supply. The impacts of the Bridge Alternatives to water supply are not discussed further.

Fill Disposal Alternatives

The proposed Fill Disposal Alternatives would not affect water supply quantities or water service to residents in the project area. Therefore, these alternatives were not analyzed further.

Exhibit 2: Final Environmental Impact Statement

4.3.1.4 Air Quality

This section discusses potential impacts of proposed project alternatives on air quality. The project alternatives would neither generate substantial emissions of nitrogen or sulfur, nor perceptibly affect visibility. Therefore, these indicators are not addressed in the assessment of impacts on park resources from airborne pollutants. Instead, impacts are assessed based on project emissions of criteria pollutants.

Guiding Regulations and Policies

The air quality management agencies of direct importance in Marin County include the EPA, ARB, and BAAQMD. The EPA has established federal standards for which the ARB and BAAQMD have primary implementation responsibility. The ARB and BAAQMD are responsible for ensuring that state standards are met. The BAAQMD is responsible for implementing strategies for air quality improvement and recommending mitigation measures for new growth and development. At the local level, air quality is managed through land use and development planning practices, and is implemented in the County through the general planning process. The BAAQMD is responsible for establishing and enforcing local air quality rules and regulations that address the requirements of federal and state air quality laws. The various regulations and agencies are described in more detail in the following sections.

Federal and State Ambient Air Quality Standards

California and the federal government have established standards for several different pollutants. For some pollutants, separate standards have been set for different measurement periods. Most standards have been set to protect public health. For some pollutants, standards have been based on other values (such as protection of crops, protection of materials, or avoidance of nuisance conditions). The pollutants of greatest concern in the project area are CO, O_3, and particulate matter 2.5 and 10 microns in diameter or less (PM 2.5 and PM10, respectively), which are inhalable. Table 4.3.1.4-1 shows the state and federal standards for a variety of pollutants.

Federal Regulations. The federal Clean Air Act (CAA), enacted in 1963 and amended several times thereafter (including the 1990 amendments), establishes the framework for modern air pollution control. The CAA directs the EPA to establish ambient air standards for six pollutants: ozone, CO, lead, NO_2, particulate matter, and SO_2. The standards are divided into primary and secondary standards; the former are set to protect human health within an adequate margin of safety, and the latter to protect environmental values, such as plant and animal life.

The primary legislation that governs federal air quality regulations is the Clean Air Act Amendments of 1990 (CAAA). The CAAA delegates primary responsibility for clean air to the EPA. The EPA develops rules and regulations

to preserve and improve air quality, as well as delegating specific responsibilities to state and local agencies.

The CAA requires states to submit a state implementation plan (SIP) for areas in nonattainment for federal standards. The SIP, which is reviewed and approved by the EPA, must demonstrate how the federal standards will be achieved. Failing to submit a plan or secure approval could lead to denial of federal funding and permits. In cases where the SIP is submitted by the state but fails to demonstrate achievement of the standards, the EPA is directed to prepare a federal implementation plan.

Federal Conformity Requirements. The CAAA require that all federally funded projects come from a plan or program that conforms to the appropriate SIP. Federal actions are subject to either the transportation conformity rule (40 CFR 51[T]), which applies to federal highway or transit projects, or the general conformity rule.

The purpose of the general conformity rule is to ensure that federal projects conform to applicable SIPs so that they do not interfere with strategies employed to attain the national ambient air quality standards (NAAQS). The rule applies to federal projects in areas designated as nonattainment areas for any of the six criteria pollutants and in some areas designated as maintenance areas. The rule applies to all federal projects except:

- programs specifically included in a transportation plan or program that is found to conform under the federal transportation conformity rule,
- projects with associated emissions below specified *de minimis* threshold levels, and
- certain other projects that are exempt or presumed to conform.

A general conformity determination would be required if a proposed action's total direct and indirect emissions fail to meet any of the following two conditions:

- emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards are below the *de minimis* levels indicated in Tables 4.3.1.4-1 and 4.3.1.4-2, and
- emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards are regionally insignificant (total emissions are less than 10% of the area's total emissions inventory for that pollutant).

Table 4.3.1.4-1. Ambient Air Quality Standards Applicable in California

			Standard (ppm)		Standard (µg/m^3)		Violation Criteria	
Pollutant	Symbol	Average Time	California	National	California	National	California	National
Ozone*	O_3	1 hour	0.09	NA	180	NA	If exceeded	NA
		8 hours	0.070	0.08	137	157	If exceeded	If fourth highest 8-hour concentration in a year, averaged over 3 years, is exceeded at each monitor within an area
Carbon monoxide	CO	8 hours	9.0	9	10,000	10,000	If exceeded	If exceeded on more than 1 day per year
		1 hour	20	35	23,000	40,000	If exceeded	If exceeded on more than 1 day per year
(Lake Tahoe only)		8 hours	6	NA	7,000	NA	If equaled or exceeded	NA
Nitrogen dioxide	NO_2	Annual average	NA	0.053	NA	100	NA	If exceeded on more than 1 day per year
		1 hour	0.25	NA	470	NA	If exceeded	NA
Sulfur dioxide	SO_2	Annual average	NA	0.03	NA	80	NA	If exceeded
		24 hours	0.04	0.14	105	365	If exceeded	If exceeded on more than 1 day per year
		1 hour	0.25	NA	655	NA	If exceeded	NA
Hydrogen sulfide	H_2S	1 hour	0.03	NA	42	NA	If equaled or exceeded	NA
Vinyl chloride	C_2H_3Cl	24 hours	0.01	NA	26	NA	If equaled or exceeded	NA
Inhalable particulate matter	PM10	Annual geometric mean	NA	NA	20	NA	If exceeded	NA
		Annual arithmetic mean	NA	NA	NA	50	NA	If exceeded at each monitor within an area
		24 hours	NA	NA	50	150	If exceeded	If exceeded on more than 1 day per year
	PM2.5	Annual geometric mean	NA	NA	NA	NA	If exceeded	NA
		Annual arithmetic mean	NA	NA	12	15	NA	If 3-year average from single or multiple community-oriented monitors is exceeded
		24 hours	NA	NA	NA	65	NA	If 3-year average of 98th percentile at each population-oriented monitor within an area is exceeded
Sulfate particles	SO_4	24 hours	NA	NA	25	NA	If equaled or exceeded	NA
Lead particles	Pb	Calendar quarter	NA	NA	NA	1.5	NA	If exceeded no more than 1 day per year
		30-day average	NA	NA	1.5	NA	If equaled or exceeded	NA

Notes: All standards are based on measurements at 25ºC and 1 atmosphere pressure. National standards shown are the primary (health effects) standards. NA = not applicable.

* The U.S. Environmental Protection Agency recently replaced the 1-hour ozone standard with an 8-hour standard of 0.08 part per million. EPA issued a final rule that revoked the 1-hour standard on June 15, 2005. However, the California 1-hour ozone standard will remain in effect.

Source: California Air Resources Board 2003.

Exhibit 2: Final Environmental Impact Statement

If any of the two conditions above are not met, then a general conformity determination must be performed to demonstrate that total direct and indirect emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards would conform with the applicable SIP.

However, if the above two conditions are met, then the requirements for general conformity do not apply, as the proposed action is presumed to conform with the applicable SIP for each affected pollutant. As a result, no further analysis or determination would be required.

Table 4.3.1.4-2. Federal *de minimis* Threshold Levels for Criteria Pollutants in Nonattainment Areas

Pollutant	Emission Rate (Tons per Year)
O_3 (VOC or NO_X)	
Serious nonattainment areas	50
Severe nonattainment areas	25
Extreme nonattainment areas	10
Other ozone nonattainment areas outside an ozone transport region	**100**
Marginal and moderate nonattainment areas inside an ozone transport region	
VOC	50
NO_X	100
CO: All nonattainment areas	100
SO_2 or NO_2: All nonattainment areas	100
PM10	
Moderate nonattainment areas	100
Serious nonattainment areas	70
Pb: All nonattainment areas	25

Source: 40 CFR 51.853

Note: *de minimis* threshold levels for conformity applicability analysis.

Bolded text indicates pollutants for which the region is in nonattainment, and a conformity determination must be made.

Table 4.3.1.4-3. Federal *de minimis* Threshold Levels for Criteria Pollutants in Maintenance Areas

Pollutant	Emission Rate (Tons per Year)
O_3 (NO_X), SO_2 or NO_2	
All maintenance areas	100
O_3 (VOCs)	
Maintenance areas inside an ozone transport region	50
Maintenance areas outside an ozone transport region	100
CO: All maintenance areas	**100**
PM10: All maintenance areas	100
Pb: All maintenance areas	25

Source: 40 CFR 51.853

Note: *de minimis* threshold levels for conformity applicability analysis.

Bolded text indicates pollutants for which the region is in nonattainment, and a conformity determination must be made.

National Park Service Regulations. National Park Service guidance regarding air quality are found in two documents—*Interim Technical Guidance on Assessing Impacts and Impairment to Natural Resources* and *Environmental Impact Methodologies and Thresholds*. The guidance found in these documents is loosely based on some of the emissions thresholds found in the Prevention of Significant Deterioration (PSD) and conformity sections of the CFR, and rationale in setting the NAAQS in the CAA.

State Regulations. Responsibility for achieving California's air quality standards, which are more stringent than federal standards, is placed on the ARB and local air districts, and is to be achieved through district-level air quality management plans that will be incorporated into the SIP. In California, the EPA has delegated authority to prepare SIPs to the ARB, which, in turn, has delegated that authority to individual air districts

The ARB has traditionally established state air quality standards, maintaining oversight authority in air quality planning, developing programs for reducing emissions from motor vehicles, developing air emission inventories, collecting air quality and meteorological data, and approving state implementation plans.

Responsibilities of air districts include overseeing stationary source emissions, approving permits, maintaining emissions inventories, maintaining air quality stations, overseeing agricultural burning permits, and reviewing air quality–related sections of environmental documents required by CEQA.

The California CAA of 1988 substantially added to the authority and responsibilities of air districts. The California CAA designates air districts as lead air quality planning agencies, requires air districts to prepare air quality plans,

and grants air districts authority to implement transportation control measures. The California CAA focuses on attainment of the state ambient air quality standards, which, for certain pollutants and averaging periods, are more stringent than the comparable federal standards.

The California CAA requires designation of attainment and nonattainment areas with respect to state ambient air quality standards. The California CAA also requires that local and regional air districts expeditiously adopt and prepare an air quality attainment plan if the district violates state air quality standards for carbon monoxide, sulfur dioxide, nitrogen dioxide, or ozone. These Clean Air Plans are specifically designed to attain these standards and must be designed to achieve an annual five percent reduction in district-wide emissions of each nonattainment pollutant or its precursors. Where an air district is unable to achieve a 5 percent annual reduction, the adoption of "all feasible measures" on an expeditious schedule is acceptable as an alternative strategy (Health and Safety Code Section 40914(b)(2)). No locally prepared attainment plans are required for areas that violate the state PM10 standards.

The California CAA requires that the state air quality standards be met as expeditiously as practicable but, unlike the federal CAA, does not set precise attainment deadlines. Instead, the act established increasingly stringent requirements for areas that will require more time to achieve the standards.

The ARB's *Air Quality and Land Use Handbook: A Community Health Perspective* (California Air Resources Board 2005) provides ARB recommendations for the siting of new sensitive land uses (including residences) near freeways, distribution centers, ports, refineries, chrome plating facilities, dry cleaners, and gasoline stations. The handbook recommends that new development be placed at distances from such facilities.

Study Area

The study area for the air quality analysis is the project site, and surrounding sensitive land uses. These land uses are described in Chapter 3 and include residences, the Pelican Inn, Golden Gate Dairy, Green Gulch Farm, and Muir Beach, a public beach. Fill hauling also considers impacts along the routes on which hauling would take place.

For the purposes of evaluating emissions with respect to attainment status, the study area is larger, and constitutes the entire San Francisco Bay Area Air Basin, which includes Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, the western half of Solano and the southern half of Sonoma Counties.

Analysis Thresholds

Construction Impacts

Construction emission thresholds have been based on the BAAQMD's *CEQA Guidelines for Assessing the Air Quality Impacts of Projects and Plans* (Bay Area Air Quality Management District 1999). According to these guidelines, project operations would result in a significant impact on air quality if they resulted in a net increase in pollutant emissions of 80 pounds per day (ppd) or 15 tons per year (tpy) of ROG, NO_X, or PM10. Thresholds have therefore been adapted as follows:

- **Negligible:** Alternative would result a net increase in pollutant emissions of up to 20 ppd or 1 tpy of ROG, NO_X, or PM10. 1 tpy is consistent the threshold shown on Table 4.3.1.4-3.
- **Minor:** Alternative would result a net increase in pollutant emissions of up to 40 ppd or 5 tpy of ROG, NO_X, or PM10. 5 tpy is consistent the threshold shown on Table 4.3.1.4-3.
- **Moderate:** Alternative would result a net increase in pollutant emissions of up to 80 ppd or 15 tpy of ROG, NO_X, or PM10.
- **Major:** Alternative would result a net increase in pollutant emissions of up to 160 ppd or 100 tpy of PM10/50 tpy of ROG or NO_X. The tpy determinations for a major impact are based on federal conformity standards

Impacts associated with emissions of the other construction-related pollutant, CO, are assessed by using the threshold levels found in Table 4.3.1.4-3. These thresholds are based on NPS guidelines for assessment of impacts to human health from airborne pollutants, as outlined in the following documents: *Interim Technical Guidance on Assessing Impacts and Impairment to Natural Resources* (National Park Service 2003) and *Environmental Impact Methodologies and Thresholds* (National Park Service 2004).

Table 4.3.1.4-4. Thresholds for Assessing Adverse Impacts on Human Health from Airborne Pollutants

Impact level	Proposed Project Emissions—NAAQS Attainment Areas		Current Air Quality
Negligible	<50 tons per year (each pollutant)	AND	<60% of the NAAQS
Minor	>50 & <100 tons per year (any pollutant)	AND	<80% of the NAAQS
Moderate	>100 tons per year (any pollutant)	OR	<80% of the NAAQS
Major	>250 tons per year (any pollutant)	AND	<80% of the NAAQS
Impact level	Proposed Project Emissions – NAAQS Nonattainment Areas		
Negligible	Net decrease in emissions from current levels		
Minor	1–5 tons per year		
Moderate	>5 tons per year and <conformity *de minimis* levels*		
Major	≥ conformity *de minimis* levels*		

Note: * *de minimis* levels are shown on 4.3.1.4-2 and 4.3.1.4-3.

Operational Emissions

As described below, the various alternatives would generate negligible additional sources of operational emissions, and are not discussed further.

Methods and Assumptions

General conformity requirements stipulate that a project's total direct and indirect emissions must be evaluated against the *de minimis* thresholds (Tables 4.3.1.4-1 and 4.3.1.4-2). The analysis below addresses each of the alternatives associated with the proposed project (Restoration Alternatives, Public Access Alternatives, Bridge Alternatives, and Fill Disposal Alternatives), and evaluates the significance of each of the project alternatives.

The proposed project will ultimately consist of one Restoration Alternative combined with one Public Access Alternative and one Bridge Design Alternative, in addition to one (or a combination) of fill disposal alternatives. Consequently, as required by the general conformity requirements, project significance will be determined by evaluating the *total* project emissions associated with the restoration, public access, bridge design, and fill disposal alternatives chosen to constitute the preferred alternative.

Project Construction

Construction activities for the proposed project would result in short-term impacts on ambient air quality in the area. Temporary construction emissions would result directly from site clearance, grading, site preparation activities, and indirectly from construction equipment emissions and construction worker commuting patterns. Pollutant emissions would vary daily depending on the level of activity, length of the construction period, the specific operations, types of equipment, number of personnel, wind and precipitation conditions, and soil

moisture content. As described in Chapter 2, construction scenarios would be very similar under all of the restoration, public access, and Bridge Alternatives. However, it is anticipated that the amount of total excavated and fill amounts, as well as construction equipment, would vary between alternatives, and would be dependent upon the size and scope of construction activities associated with the alternatives.

Construction of the proposed project could involve various types of equipment, including compressors/jack hammers, excavators, backhoes, scrapers, water trucks, compactors, front-end loaders, cranes, forklifts, flat-bed delivery trucks, end and bottom dump trucks, ten-wheel dump trucks, paving equipment, concrete delivery trucks, and welding equipment. However, a detailed inventory of construction equipment that will be used during construction of the proposed project was not provided; consequently, construction-related emissions were estimated and analyzed based on the anticipated construction equipment calculated by URBEMIS 2002 and professional judgment.

To represent a worst-case scenario, this analysis assumes a high degree of construction activity (i.e., simultaneous use of multiple pieces of construction equipment). It is anticipated that construction activities would occur over a three to four–year construction schedule, depending on the project alternative, commencing in 2007. The construction season would occur from April to October of each year, for a total of six months of construction per season. Further, it was assumed that the construction duration would be twenty-two 8-hour days of construction per month.

Project Operations

This Final EIS/EIR assumes that the project would not result in changes in visitation to Muir Beach. Therefore, any change in operational emissions associated with visitation, such as motor vehicle exhaust resulting from vehicles accessing the parking lot and emissions from grills used for outdoor cooking, is considered negligible. Vehicle emissions that are the result of changes to parking lot size would not be substantial, since ultimately the number of vehicle trips to the site would be unchanged, and compared to the average trip length to the site (assumed to be 50 miles), the additional emissions associated with circling the parking lot or waiting in queue would be minimal.

In addition, the project alternatives do not involve actions that would generate additional operational emissions. Emissions from vehicle trips associated with maintenance of the site would be the same regardless of whether the project is implemented.

For these reasons, emissions associated with project operations are not considered further.

Restoration Alternatives

Table 4.3.1.4-5 summarizes the potential impacts of the Restoration Alternatives on air quality in the study area. The Restoration Alternatives are described in Chapter 2.

Table 4.3.1.4-5. Potential Air Quality Impacts from Restoration Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				
Impact	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	Mitigation Measure
AIR-R1: Generation of Construction-Related Pollutant Emissions	Negligible	Minor Adverse/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse/ Moderate Adverse**	AIR-MM-1: Implement All Applicable BAAQMD Dust Control Measures. AIR-MM-2: Reduce NO_X Emissions from Off-Road Diesel-Powered Equipment.

Impact AIR-R1: Generation of Construction-Related Pollutant Emissions (Short-Term, Year 0)

The primary source of air pollutant emissions associated with construction of the Restoration Alternatives is exhaust from construction equipment, which includes off-road equipment and haul trucks used to transport fill/excavated material. As previously indicated, a detailed inventory of construction equipment is not available. Consequently, this analysis is based on assumed construction equipment, and Table 4.3.1.4-6 summarizes the equipment estimated for each of the Restoration Alternatives. Estimates of total excavated and fill amounts associated with the Restoration Alternatives are summarized in Table 2-6, described in Chapter 2. It was assumed that excess excavated material would be stored at an on-site stockpile, and then placed in a truck and hauled to its final disposal site. The haul distance to the on-site stockpile was assumed to be 1,500 feet. The emissions associated with hauling excess excavated material to the on-site stockpile were estimated for each of the Restoration Alternatives. Emissions associated with hauling excess excavated material from the on-site stockpile to the final disposal site are addressed under the Fill Disposal Alternatives.

Table 4.3.1.4-6. Summary of Anticipated Construction Equipment Associated with the Restoration Alternatives

Equipment	Alternative 2 Creek	Alternative 3 Small Lagoon	Alternative 4 Big Lagoon
Tractor/loader/backhoe	2	3	4
Compactor/roller	1	2	3
Crane	1	1	1
Excavator	2	3	4
Forklift	1	2	3
Front-end loader	1	2	3
Jack hammer	1	2	3
Scraper	1	2	3

To represent a worst-case scenario, it was assumed that all construction equipment associated with the Restoration Alternatives would be used simultaneously over a three-year period for Alternative 2, and a four-year period for Alternatives 3 and 4. It was also assumed that construction activities for the Restoration Alternatives would occur from April to October of each year, for a total of six months of construction. Table 4.3.1.4-7 summarizes construction emissions for each of the Restoration Alternatives in pounds per day; Table 4.3.1.4-8 summarizes construction emissions for each of the Restoration Alternatives in tons per year.

Table 4.3.1.4-7. Summary of Emissions Associated with Construction of the Restoration Alternatives (pounds per day)

	Unmitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
Alternative 2 Creek	9.6	58.1	83.5	27.3	1.9	25.4
Alternative 3 Small Lagoon	16.7	100.6	145.1	96.7	3.3	93.5
Alternative 4 Big Lagoon	23.8	143	206.7	98.2	4.7	93.5
	Mitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
Alternative 2 Creek	9.6	40.1	83.5	10.1	0.1	10.0
Alternative 3 Small Lagoon	16.7	69.4	145.1	37.0	0.2	36.7
Alternative 4 Big Lagoon	23.8	98.6	206.7	37.1	0.3	36.7

Table 4.3.1.4-8. Summary of Emissions Associated with Construction of the Restoration Alternatives (tons per year)

	Unmitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
Alternative 2 Creek	0.7	3.8	5.5	1.8	0.1	1.7
Alternative 3 Small Lagoon	1.1	6.6	9.6	6.4	0.2	6.2
Alternative 4 Big Lagoon	1.6	9.4	13.6	6.5	0.3	6.2
	Mitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
Alternative 2 Creek	0.7	2.6	5.5	0.6	0.0	0.6
Alternative 3 Small Lagoon	1.1	4.6	9.6	2.4	0.0	2.4
Alternative 4 Big Lagoon	1.6	6.5	13.6	2.4	0.0	2.4

As previously described, it is anticipated that construction activities would occur over a three- to four-year construction schedule, depending on the project alternative, commencing in 2007. In addition, should the bridge be constructed later, certain restoration activities (e.g., realignment of the upper portion of Redwood Creek) would occur at that time, rather than at the time of the larger restoration project. Consequently, construction impacts associated with the Restoration Alternatives are anticipated to be short term and will cease once construction activities have ceased.

Restoration Alternative 1: Negligible. Periodic maintenance dredging activities would be anticipated to have emissions that are substantially less than any of the action alternatives, given the smaller scope of the activities.

Restoration Alternative 2: Minor adverse. As indicated in Table 4.3.1.4-8, construction emissions associated with Restoration Alternative 2 are consistent with the thresholds for minor impacts. Interim flood reduction measures would have even smaller emissions given the smaller scope of activities. While impacts are not considered significant, Mitigation Measure AIR-MM-1 is required by the BAAQMD, and Mitigation Measure AIR-MM-2 is recommended.

Restoration Alternative 3: Moderate adverse. As indicated in Table 4.3.1.4-8, NO_X and PM10 emissions associated with construction of Restoration Alternative 3 are consistent with the thresholds for moderate impacts. Interim flood reduction measures would have smaller emissions given the smaller scope of activities. Impacts are considered significant. Mitigation Measures AIR-MM-1 and AIR-MM-2 would lower impacts to a less-than-significant level.

Restoration Alternative 4: Moderate adverse. As indicated in Table 4.3.1.4-8, NO_X and PM10 emissions associated with construction of Restoration Alternative 4 are consistent with the thresholds for moderate impacts. Interim

flood reduction measures would have smaller emissions given the smaller scope of activities. Impacts are considered significant. Mitigation Measures AIR-MM-1 would reduce impacts related to PM10 to a less-than-significant level. However, Mitigation Measure AIR-MM-2 would reduce NO_X emissions, but they would still exceed the significance threshold of 80 ppd. As a result, construction related impacts related to NO_X are considered significant and unavoidable following mitigation.

Public Access Alternatives

Table 4.3.1.4-9 summarizes the potential impacts of the Public Access Alternatives on air quality in the study area. The Public Access Alternatives are described in Chapter 2.

Table 4.3.1.4-9. Potential Air Quality Impacts from Public Access Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							
Impact	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Al C	Mitigation Measure
AIR-P1: Generation of Construction-Related Pollutant Emissions	Negligible	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	AIR-MM-1 AIR-MM-2

Impact AIR-P1: Generation of Construction-Related Pollutant Emissions (Short-Term, Year 0)

The primary source of air pollutant emissions associated with construction of the Public Access Alternatives is exhaust from construction equipment, which includes off-road equipment and haul trucks used to transport fill/excavated material. As previously indicated, a detailed inventory of construction equipment is not available. Consequently, this analysis is based on assumed construction equipment, and Table 4.3.1.4-10 summarizes the equipment estimated for each of the Public Access Alternatives. Estimates of total excavated and fill amounts associated with the Public Access Alternatives are summarized in Table 2-7, described in Chapter 2. It was assumed that excess excavated material would be stored at an on-site stockpile, and then placed in a truck and hauled to its final disposal site. The haul distance to the on-site stockpile was assumed to be 1,500 feet. The emissions associated with hauling excess excavated material to the on-site stockpile were estimated for each of the Public Access Alternatives. Emissions associated with hauling excess excavated material from the on-site stockpile to the final disposal site are addressed under the Fill Disposal Alternatives.

Table 4.3.1.4-10. Summary of Anticipated Construction Equipment Associated with the Public Access Alternatives

Equipment	Alternatives B1 through C
Tractor/loader/backhoe	1
Compactor/roller	1
Grader	1
Paver	1
Rubber-tired dozer	1

To represent a worst-case scenario, it was assumed that all construction equipment associated with the Public Access Alternatives are operated simultaneously during the same year over a two-month construction period starting in April 2007. Table 4.3.1.4-11 summarizes construction emissions for each of the Public Access Alternatives in pounds per day; Table 4.3.1.4-12 summarizes construction emissions for each of the Public Access Alternatives in tons per year.

Table 4.3.1.4-11. Summary of Emissions Associated with Construction of the Public Access Alternatives (pounds per day)

	Unmitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
B2	4.3	32.9	36.0	4.2	1.5	2.8
B3	4.3	32.9	36.1	5.2	1.5	3.8
B4	4.2	24.7	36.1	4.9	0.9	4.0
B5	4.3	32.9	36.1	6.5	1.5	5
C	4.3	32.9	36.1	5.0	1.5	3.5
	Mitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
B2	4.3	22.7	36.0	1.2	0.1	1.1
B3	4.3	22.7	36.1	1.6	0.1	1.5
B4	4.2	17.2	36.1	1.7	0.1	1.6
B5	4.3	22.7	36.1	2.1	0.1	2.0
C	4.3	22.7	36.1	1.5	0.1	1.4

Table 4.3.1.4-12. Summary of Emissions Associated with Construction of the Public Access Alternatives (tons per year)

	Unmitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
B2	0.1	0.6	0.8	0.0	0.0	0.0
B3	0.1	0.6	0.8	0.0	0.0	0.0
B4	0.1	0.5	0.7	0.0	0.0	0.0
B5	0.1	0.6	0.8	0.0	0.0	0.0
C	0.1	0.6	0.8	0.0	0.0	0.0
	Mitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
B2	0.1	0.4	0.8	0.0	0.0	0.0
B3	0.1	0.4	0.8	0.0	0.0	0.0
B4	0.1	0.3	0.7	0.0	0.0	0.0
B5	0.1	0.4	0.8	0.0	0.0	0.0
C	0.1	0.4	0.8	0.0	0.0	0.0

While construction activities could occur anytime over the three- to four-year construction schedule, depending on the Restoration Alternative, it is anticipated that construction activities related to the Public Access Alternatives would be intermittent and of varying intensity. Construction impacts associated with the Public Access Alternatives are anticipated to be short term and will cease once construction activities have ceased.

Public Access Alternative A: Negligible. No construction activities would occur as a result of Public Access Alternative A. Consequently, there would be no emissions.

Public Access Alternatives B1, B2, B3, B4, B5, C: Minor adverse. As indicated in Table 4.3.1.4-12, construction emissions associated with Public Access Alternatives are consistent with the thresholds for negligible to minor impacts. While impacts are not considered significant, Mitigation Measure AIR-MM-1 is required by the BAAQMD, and Mitigation Measure AIR-MM-2 is recommended.

Bridge Alternatives

Table 4.3.1.4-13 summarizes the potential impacts of the Bridge Alternatives on air quality in the study area. The Bridge Alternatives are described in Chapter 2.

Table 4.3.1.4-13. Potential Air Quality Impacts from Bridge Alternatives

Impact	Impact Level (before Mitigation/after Mitigation) **Bold** denotes a significant adverse impact					Mitigation Measures
	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	
Impact AIR-B1: Generation of Construction-Related Pollutant Emissions	Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	AIR-MM-1 AIR-MM-2

Impact AIR-B1: Generation of Construction-Related Pollutant Emissions (Short-Term, Year 0)

The primary source of air pollutant emissions associated with construction of the Bridge Alternatives is exhaust from construction equipment, which includes off-road equipment and haul trucks used to transport fill/excavated material. As previously indicated, a detailed inventory of construction equipment is not available. Consequently, this analysis is based on assumed construction equipment, and Table 4.3.1.4-14 summarizes the equipment estimated for each of the Bridge Alternatives. Estimates of total fill amounts associated with the Bridge Alternatives are summarized in Table 2-5, described in Chapter 2. The haul distance for fill was assumed to be 1,500 feet.

Table 4.3.1.4-14. Summary of Anticipated Construction Equipment Associated with the Bridge Alternatives

Equipment	Alternatives BR1 through BR4
Compactor/roller	1
Crane	1
Forklift	1
Grader	1
Paver	1

To represent a worst-case scenario, it was assumed that all construction equipment associated with the Bridge Alternatives would be operated simultaneously during the same year over a two-month construction period. Table 4.3.1.4-15 summarizes construction emissions for each of the Bridge Alternatives in pounds per day, while Table 4.3.1.4-15 summarizes construction emissions for each of the Bridge Alternatives in tons per year.

Table 4.3.1.4-15. Summary of Emissions Associated with Construction of the Bridge Alternatives (pounds per day)

	Unmitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
BR1	4.1	24.2	35.9	1.2	0.8	0.4
BR2	4.1	24.2	35.9	1.2	0.8	0.4
BR3	4.1	24.2	36.0	2.0	0.8	1.2
BR4	4.1	24.3	36.0	3.3	0.4	2.5
	Mitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
BR1	4.1	16.7	35.9	0.2	0.1	0.2
BR2	4.1	16.7	35.9	0.2	0.1	0.2
BR3	4.1	16.7	36.0	0.5	0.1	0.5
BR4	4.1	16.8	36.0	1.1	0.1	1.0

Table 4.3.1.4-16. Summary of Emissions Associated with Construction of the Bridge Alternatives (tons per year)

	Unmitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
BR1	0.1	0.5	0.8	0.0	0.0	0.0
BR2	0.1	0.5	0.8	0.0	0.0	0.0
BR3	0.1	0.5	0.8	0.0	0.0	0.0
BR4	0.1	0.5	0.8	0.0	0.0	0.0
	Mitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
BR1	0.1	0.4	0.8	0.0	0.0	0.0
BR2	0.1	0.4	0.8	0.0	0.0	0.0
BR3	0.1	0.4	0.8	0.0	0.0	0.0
BR4	0.1	0.4	0.8	0.0	0.0	0.0

Construction activities could occur anytime over the three- to four-year construction schedule, depending on the Restoration Alternative, or could occur later (after completion of the restoration). It is anticipated that construction activities related to the Bridge Alternatives would be concentrated during a specific period. Construction impacts associated with the Bridge Alternatives are anticipated to be short term and will cease once construction activities have ceased.

Bridge Alternative BR0: No impact. No construction activities would occur as a result of this alternative.

Bridge Alternative BR1, BR2, BR3, BR4: Minor adverse. As indicated in Table 4.3.1.4-16, construction emissions associated with Bridge Alternatives are consistent with the thresholds for negligible to minor impacts. While impacts are not considered significant, Mitigation Measure AIR-MM-1 is required by the BAAQMD, and Mitigation Measure AIR-MM-2 is recommended.

Fill Disposal Alternatives

Table 4.3.1.4-17 summarizes the potential impacts of the Fill Disposal Alternatives on air quality in the study area. The Fill Disposal Alternatives are described in Chapter 2.

Table 4.3.1.4-17. Potential Air Quality Impacts from Fill Disposal Alternatives

	Impact Level (before Mitigation/after Mitigation) **Bold** denotes a significant adverse impact					
Impact	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail*	Mitigation Measure
AIR-F1: Generation of Construction-Related Pollutant Emissions	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	AIR-MM-1 AIR-MM-2 AIR-MM-3: Limit the Daily Number of Fill Disposal Trips

* The analysis of the two trail alternatives only considers the effects of hauling the fill to the sites. For the coastal trail, impacts of using the fill to recontour the trail are also considered.

Impact AIR-F1: Generation of Construction-Related Pollutant Emissions (Short-Term, Year 0)

The primary source of air pollutant emissions associated with the Fill Disposal Alternatives is exhaust from construction equipment, which includes loaders and haul trucks used to transport fill/excavated material. This analysis is based on assumed construction equipment of two loaders operating at the disposal sites. To represent a worst-case scenario, it was assumed that there would be a maximum of 50 truck trips per day moving 500 cubic yards of material per day. Round-trip haul travel lengths used in the analysis for the Unused Reservoir Pit, Upper Banducci, Hamilton AFB, Dias Ridge Trail, and Coastal Trail Fill Disposal Alternatives were assumed to be 1.5, 1.0, 40.0, 5.0, and 1.48 miles, respectively. Estimates of total excavated and fill amounts associated with the Fill Disposal Alternatives are summarized in Table 2-8, described in Chapter 2. It was also assumed that all hauling associated with the Fill Disposal Alternatives would

occur within the same year over a six-month construction period starting in April 2007.

Table 4.3.1.4-18 summarizes construction emissions for each of the Fill Disposal Alternatives in pounds per day; Table 4.3.4-19 summarizes construction emissions for each of the Fill Disposal Alternatives in tons per year.

Table 4.3.1.4-18. Summary of Emissions Associated with the Fill Disposal Alternatives (pounds per day)

	Unmitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
Unused Reservoir Pit	1.4	11.6	11.0	220.5	0.5	220.0
Upper Banducci	0.8	6.1	5.6	220.3	0.3	220.0
Hamilton AFB	5.7	63.5	32.9	222.4	2.2	220.2
Dias Ridge Trail	1.1	10.4	6.7	220.4	0.4	220.0
Coastal Trail	1.4	11.5	11.0	220.5	0.5	220.0
	Mitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
Unused Reservoir Pit	1.4	8.5	11.0	86.5	0.1	86.4
Upper Banducci	0.8	4.5	5.6	86.5	0.1	86.4
Hamilton AFB	5.7	57.3	32.9	88.0	1.4	86.6
Dias Ridge Trail	1.1	8.9	6.7	86.6	0.2	86.4
Coastal Trail	1.4	8.5	11.0	86.5	0.1	86.4

Table 4.3.1.4-19. Summary of Emissions Associated with the Fill Disposal Alternatives (tons per year)

	Unmitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
Unused Reservoir Pit	0.1	0.8	0.7	14.6	0.0	14.5
Upper Banducci	0.0	0.4	0.4	14.5	0.0	14.5
Hamilton AFB	0.4	4.2	2.2	14.7	0.1	14.5
Dias Ridge Trail	0.0	0.07	0.4	14.5	0.0	14.5
Coastal Trail	0.1	0.8	0.7	14.6	0.0	14.5
	Mitigated					
Alternative	ROG	NO_X	CO	PM10 (total)	PM10 (exhaust)	PM10 (dust)
Unused Reservoir Pit	0.1	0.6	0.7	5.7	0.0	5.7
Upper Banducci	0.0	0.3	0.4	5.7	0.0	5.7
Hamilton AFB	0.4	3.8	2.2	5.8	0.1	5.7
Dias Ridge Trail	0.0	0.6	0.4	5.7	0.0	5.7
Coastal Trail	0.1	0.6	0.7	5.7	0.0	5.7

All Alternatives: Major adverse. As indicated in Table 4.3.1.4-19, construction emissions of PM10 are consistent with the threshold for a major impact. As shown in the table, Mitigation Measure AIR-MM-1 would not reduce impacts below moderate levels; therefore, implementation of Mitigation Measure AIR-MM-3, which would limit the daily number of fill disposal trips, is required. In addition, Mitigation Measure AIR-MM-2 is recommended to further reduce emissions.

Mitigation Measures

Mitigation Measure AIR-MM-1: Implement All Applicable BAAQMD Dust Control Measures

NPS shall implement all feasible and practicable control measures for construction emissions of PM10 as required by BAAQMD (Bay Area Air Quality Management District 1999). These control measures are summarized in Table 4.3.1.4-20.

Table 4.3.1.4-20. BAAQMD Feasible Control Measures for Construction Emissions of PM10

Basic Control Measures—The following controls should be implemented at all construction sites.
• Water all active construction areas at least twice daily. • Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard. • Pave, apply water three times daily, or apply (nontoxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites. • Sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites. • Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets.
Enhanced Control Measures—The following measures should be implemented at construction sites greater than 4 acres in area.
• Hydroseed or apply (non-toxic) soil stabilizers to inactive construction areas (previously graded areas inactive for ten days or more). • Enclose, cover, water twice daily or apply (non-toxic) soil binders to exposed stockpiles (dirt, sand, etc.) • Limit traffic speeds on unpaved roads to 15 mph. • Install sandbags or other erosion control measures to prevent silt runoff to public roadways. • Replant vegetation in disturbed areas as quickly as possible.
Optional Control Measures—The following control measures are strongly encouraged at construction sites that are large or located near sensitive receptors, or that may warrant additional emissions reductions for any other reason.
• Install wheel washers for all exiting trucks, or wash off the tires or tracks of all trucks and equipment leaving the site. • Install windbreaks, or plant trees/vegetative windbreaks at windward side(s) of construction areas. • Suspend excavation and grading activity when winds (instantaneous gusts) exceed 25 mph. • Limit the area subject to excavation, grading and other construction activity at any one time.
Source: BAAQMD 1999.

Mitigation Measure AIR-MM-2: Reduce NO_X Emissions from Off-Road Diesel-Powered Equipment.

The project shall prepare and implement ~~provide a plan, for approval by the lead agency and BAAQMD,~~ a plan demonstrating that the heavy-duty (> 50 horsepower) off-road vehicles to be used in the construction project (including owned, leased, and subcontractor vehicles) will achieve a project-wide fleet-average 20 percent NO_X reduction and 45% particulate reduction compared to the most recent ARB fleet average at time of construction. Acceptable options for reducing emissions may include, but are not limited to:

- use of late model engines,
- low-emission diesel products,
- alternative fuels (e.g., aqueous diesel fuel),
- engine retrofit technology (e.g., diesel particulate filters, diesel oxidation catalysts, lean-NO_X catalysts),

- after-treatment products, and/or
- other options as they become available.

Mitigation Measure AIR-MM-3: Limit the Daily Number of Fill Disposal Trips

Total PM10 emissions shall be maintained below the 80 ppd standard. One method for achieving this would be to limit the number of fill disposal trips to 46 round-trips per day (based on 10-CY trucks).

Exhibit 2: Final Environmental Impact Statement

4.3.2 Biological Resources

4.3.2.1 Vegetation Communities and Wetlands

Guiding Regulations and Policies

The NPS Organic Act, which directs parks to conserve wildlife and other park resources unimpaired for future generations, is interpreted by NPS to mean that native plant life should be protected and perpetuated as part of the park's natural ecosystem. Natural processes are relied on to maintain populations of native species to the greatest extent possible; otherwise they are protected from harvest, harassment, or harm by human activities.

NPS Management Policies 2006 (National Park Service 2006a) state: "The National Park Service will maintain as parts of the natural ecosystems of parks all native plants and animals." The policies go on to state that:

- Flowering plants, ferns, mosses, lichens, algae, fungi, and microscopic plants are included;
- The natural abundances, diversities, dynamics, distributions, habitats, and behaviors of these native species are preserved and protected; and
- The introduction of exotic (nonnative) species into units of the national park system should be prevented.

Policy manual NPS-77, Natural Resource Management (National Park Service 1991) also provides general guidelines on vegetation management.

The ESA (16 USC 1431 et seq.) mandates that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. If the NPS determines that an action may adversely affect a federally listed species, consultation with the USFWS is required to ensure that the action will not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat.

California Fish and Game Code Section 1600 et seq. (Lake or Streambed Alteration Agreements) regulates activities that interfere with the natural flow of (or that substantially alter) the channel, bed, or bank of a lake, river, or stream in California. Requirements to protect the integrity of biological resources and water quality are often conditions of streambed alteration agreements administered under Section 1600 et seq. It bears noting that this does not apply to federal actions on federal land (e.g., portions of the project site).

NEPA (and in the case of this project, CEQA) requires the NPS to avoid, minimize, and mitigate negative impacts on sensitive habitats and special-status species. In the case of CEQA, this is only required for "significant" impacts.

Sensitive habitats are identified by the DFG or the USFWS, and include riparian habitat. *Special-status species* are plants and animals that are legally protected under state or federal laws or other regulations, as well as species considered sufficiently rare by the scientific community to qualify for such listing. Special-status species include the following categories of plants.

- Plants listed or proposed for listing as threatened or endangered under the ESA or California Endangered Species Act (CESA).
- Plants that are candidates for possible future listing as threatened or endangered under ESA or CESA.
- Plants listed as rare under the California Native Plant Protection Act.
- Plants that meet the CEQA definition of rare or endangered, including those considered by the CNPS to be "rare, threatened, or endangered in California" (CNPS Lists 1B [rare, threatened, or endangered in California and elsewhere] and 2 [rare, threatened, or endangered in California but more common elsewhere]).

Marin County has enacted a Streamside Conservation Area (SCA) (Marin County Code, Title 22, Section 22.56-G(3)); however, within the Coastal Zone, the SCA is defined by the Local Coastal Program (LCP). Buffers in the Coastal Zone are defined to include all riparian vegetation on both sides of the stream and the area 50 feet landward from the edge of the riparian vegetation (Marin County Comprehensive Planning Department 1981). In no case shall the stream buffer be less than 100 feet in width, from either side of the stream, as measured from the top of the stream bank. No development or vegetation removal is permitted within this buffer unless no alternative sites are feasible. LCP jurisdiction includes non-federal lands; federal lands are subject to a consistency determination under the Coastal Zone Management Act (CZMA), which verifies that the federal action is consistent with CZMA, and by extension, the LCP.

Wetlands are protected by a specific set of laws and regulations. The protection of wetlands within NPS units is facilitated through the following.

- Executive Order 11990, Protection of Wetlands—requires that federal agencies work to minimize the destruction, loss, or degradation of wetlands.
- NPS Director's Order 77-1, Wetland Protection, and its accompanying Procedural Manual 77-1 (DO 77-1 and PM 77-1)—provide specific procedures for implementing Executive Order 11990 on NPS lands. PM 77-1 requires that a Statement of Findings be prepared if actions would have adverse impacts on wetlands unless the action meets specific exception criteria (4.2.A.1). It has been determined that this action meets exception criteria 4.2.A.1.(e), and hence a Statement of Findings is not required.
- Rivers and Harbors Act, Section 10 and Clean Water Act, Section 404—authorize USACE to regulate construction and disposal of dredged material in waters of the United States, which include wetlands.
- The "no net loss" goal—intended to minimize or eliminate loss of wetland acreage in the United States—was outlined by the White House Office on

Environmental Policy in 1993. This has been subsequently updated by more recent guidance from the USACE, including use of a watershed-based approach for evaluation of effects on waters of the United States, as well as considering the functions and values of wetlands in combination with acreage when considering impacts.

Study Area

The study area for vegetation communities and wetlands is the project area as described in Chapter 2.

Analysis Thresholds

Vegetation Communities

The following thresholds were used in determining impacts on vegetation communities:

- **Negligible:** Alternative would result in no noticeable changes in the areal extent and/or ecological function of a native plant community.
- **Minor:** Alternative would result in small but noticeable changes in the areal extent (less than 5 percent of total extent of that plant community in the project area), ecological function, and/or a noticeable change in the richness of nonnative species within a native plant community.
- **Moderate:** Alternative would result in easily noticeable changes in the areal extent (5–25 percent of total extent of that plant community in the project area), ecological function, and/or a substantial change in the richness of nonnative species within a native plant community.
- **Major:** Alternative would result in highly noticeable changes in the areal extent (greater than 25 percent of total extent of that plant community in the project area), ecological function, and/or a widespread substantial change in the richness of nonnative species within a native plant community.

Wetlands/Waters of the United States

The following thresholds were used in determining impacts on waters of the United States.

- **Negligible:** Alternative would result in no measurable changes in the areal extent, or the ecological functions and values, of waters of the United States.
- **Minor:** Alternative would result in measurable changes in the areal extent, or the ecological functions and values, of waters of the United States, affecting less than 5% of the project area, and/or not resulting in a noticeable change in ecological functions and values.
- **Moderate:** Alternative would result in measurable changes in the areal extent, or the ecological functions and values, of waters of the United States,

affecting between 5 and 20% of the project area and/or resulting in a noticeable change in ecological functions and values.

- **Major:** Alternative would result in measurable changes in the areal extent, or the ecological functions and values, of waters of the United States, affecting more than 20% of the project area and resulting in a highly noticeable, widespread change in ecological functions and values.

Special-Status Plant Species

The following thresholds were used to determine impacts on special-status plant species:

- **Negligible:** Alternative would result in an imperceptible or not measurable (undetectable) change in the areal extent of habitat for special-status plant species at the project site.
- **Minor:** Alternative would result in a small, measurable, perceptible, and localized change in the areal extent of habitat for a special-status plant species at the project site.
- **Moderate:** Alternative would result in a change in the areal extent of habitat for a special-status plant species such that is apparent, measurable, and sufficient to cause a change in the resource (e.g., abundance, distribution, quantity, or quality). Less localized than a minor impact. For adverse impacts, habitat for the plant species may be eliminated or highly restricted on the project site.
- **Major:** Alternative would result in a change in the areal extent of habitat for a special-status plant species that is substantial, highly noticeable, and with the potential for landscape-scale effects and major irreversible population effects.

Methods and Assumptions

Vegetation Communities

The abundance, as defined by extent of coverage, of an individual vegetation community is important when considering impacts because the park is mandated to protect and maintain all native plant communities. In a vegetation community that is very rare in the project area or the region, such as dune habitat, adverse impacts on this community may be more significant. However, in general, the shift in the mosaic of vegetation communities under the various alternatives is considered neither inherently beneficial nor adverse. Rather, relative changes in extent of specific vegetation communities have been presented in the interest of full disclosure and to assist the reader in understanding the differences between the alternatives. In cases where such a shift would have secondary impacts (e.g., changes in habitat for species of interest), these are identified.

The presence and abundance of nonnative plants in or around the affected vegetation community is an important consideration because many nonnative plant species are stimulated to grow or reproduce as a result of ground

disturbance. Some nonnative plant species can have the following substantial adverse effects on native vegetation.

- Nonnative plants can out-compete native plants for light, nutrients, water, and growing space, which, in the worst case, can lead to extinction or local extirpation of rare plant species;
- They can degrade the quality of wildlife habitat by out-competing native food sources, or altering nesting or resting habitat;
- They can disrupt the genetic integrity of native plants if crossbreeding occurs; and
- They can change fire regimes by converting habitat types (e.g., converting a shrub or forested landscape with little under-story to one that has a continuous herbaceous layer, or converting an open grassland to forest).

Restoration of ecological processes, such as natural hydrologic regimes, can also be used as a tool, in conjunction with other management activities, to control nonnative plant species, and the abundance and density of these plants in comparison to the native plant component can be an important factor in evaluating the potential effects of treatment actions. For example, increasing the frequency and duration of inundation in an area dominated by nonnative species associated with moist habitats, such as bristly ox-tongue and teasel, could favor native wetland species.

Vegetation in the project area was mapped and described in the course of several studies, and the following studies were reviewed to determine the extent and quality of vegetation communities and wetlands in the project area. It was assumed that conditions have not changed extensively since publication of these studies.

- 2003 wetland mapping using USACE methods and the Cowardin classification system (Parravano et al. 2002; Castellini et al. 2003).
- 1994 environmental assessment (Philip Williams & Associates et al. 1994).
- 2003 site analysis report (Philip Williams & Associates et al. 2003).

The impact assessment considered effects of all restoration, public access, bridge, and fill disposal alternatives on all vegetation communities. This initial assessment was followed by a set of additional assessments of special considerations and impacts unique to individual communities. The methods used to determine assessment parameters, and the impacts the Restoration Alternatives would have on those parameters, are listed below.

- Determine key ecosystem processes (past and present) that structure the composition of each vegetation community.
  - Fluvial ecosystem processes that structure vegetation communities on-site, such as sediment transport and flooding, are described in the 1994 environmental assessment and 2003 site analysis report. Potential impacts of Restoration Alternatives on these processes were determined

by reference to the 2003 site analysis report discussion of Restoration Alternatives. (Philip Williams & Associates 2003.)

- The role of disturbance as a key process in structuring the composition of plant communities, particularly with regard to the population size of nonnative invasive species, was determined through reference to a thesis on the control of Cape ivy (Alvarez 1999) and a report entitled "Evaluation of the Potential Effects of Native Riparian Plant Restoration Actions to Listed Anadromous Fish, Critical Habitat, and Essential Fish Habitat (Magnuson-Stevens Fishery Conservation and Management Act)." (Alvarez et al. 2004).

- Identify areal extent and relative abundance or rarity of vegetation communities in the project area and in the region.
  - Existing areal extent was determined based on the reports listed above.
  - Changes in extent and type of community were projected based on changes in surface and groundwater elevation, as calculated for all alternatives in Philip Williams & Associates et al. (2003) and presented in Chapter 2. It should be noted that, as described in Phillips Williams and Associates et al. (2003), the lowering of groundwater predicted in the model represents the greatest lowering of groundwater that may occur under a worst-case scenario. It is likely that groundwater levels will not be lowered as much as predicted in the model. Furthermore, some wetland vegetation present on the site is expected to persist, at least until Year 5, even if the period of inundation or saturation is reduced. For example, cattails populations that became established in the current hydrologic regime would be expected to persist, at least over the short term, in a drier regime. However, over the long term, cattail populations are expected to become less vigorous and grow more slowly under drier conditions (Vaccaro 2005). Predictions of conversion of emergent wetlands to riparian forest and scrub therefore are likely to overestimate the losses of emergent wetlands that will occur. However, these predictions were used to ensure that mitigation would be adequate for the greatest losses of emergent wetlands that may occur.
  - As previously stated, the shift in the mosaic of vegetation communities under the various alternatives is not considered either inherently beneficial or adverse. Rather, relative changes in extent of specific vegetation communities have been presented in the interest of full disclosure and to assist the reader in understanding the differences between the alternatives. In cases where such a shift would have secondary impacts (e.g., changes in habitat for species of interest), these are identified.

- Ascertain abundance and relative cover of nonnative plants within or adjacent to the vegetation communities affected.
  - Current abundance and potential for spread of nonnative plants under the Restoration Alternatives was determined by reference to Alvarez (1999) and Alvarez et al. (2004). Potential for spread of nonnative plants was

determined based on the extent to which their habitat (e.g., riparian habitat in the case of Cape ivy) would increase under each Restoration Alternative.

Wetlands/Waters of the United States

For this assessment, wetlands and other waters of the United States under USACE jurisdiction that could be subject to impacts were identified using the wetland delineation for the project area (Castellini et al. 2003), revised to reflect comments from the USACE during its July 2006 site visit to evaluate the delineation (Figure 3.2.1-1). Impacts were evaluated considering both the areal extent and the functions and values of the wetland systems. It is assumed that if these parameters were altered as a result of restoration activities, the wetland would be subject to impacts, either beneficial or adverse. The areal extent of wetland is governed by the frequency and duration of inundation and/or saturation in a given area. Changes to the frequency and duration of inundation in the project area were determined based on the 2003 site analysis report, including projected changes in groundwater levels (Philip Williams & Associates et al. 2003), which based its analysis of the Restoration Alternatives on projected surface and groundwater elevations. As noted above in the discussion of vegetation communities, this method is likely to overestimate the wetland area that will be lost, but was used to ensure that mitigation will be adequate for the greatest potential losses.

Most of the vegetation communities identified in the project area are considered potentially jurisdictional wetlands, including the riparian forest (termed “riparian wetland”) in the project area. Impacts are considered approximate given the fact that detailed design drawings have not been prepared to allow for a precise calculation of impacts on jurisdictional waters. The conceptual project designs prepared by Philip Williams & Associates, and associated acreage calculations, have therefore been used as a proxy to calculate approximate changes in areal extent of waters of the United States.

It was assumed that no net impacts to jurisdictional wetlands would occur due to relocation of the fill pad where AT&T utility boxes are currently located adjacent to Pacific Way. The fill pad would be relocated elsewhere on the site, probably closer to Hwy 1 and adjacent to the new emergency access road, the location of which has not been determined. It is assumed that the current location of the fill pad would be restored to jurisdictional wetlands, and that the relocated fill pad would not be any larger than the existing pad. The relocated pad would be sited carefully to avoid impacts to channel morphology.

Special-Status Plant Species

While no special-status plant species are known to occur at the site, restoration activities could alter the amount of habitat available for future colonization by special-status plant species. Even management actions designed to benefit habitat, such as restoration, can have inadvertent adverse effects on these habitats; for example, changes in the areal extent of vegetation communities that provide habitat for special-status species.

The following parameters were used to evaluate the consequences of the various alternatives on special-status plant species.

- The species potential related to a given habitat and its degree of local, regional, national, and global rarity.
- The rarity of the genotype or subspecies, regionally, nationally, or globally.
- The proportion of the species range affected by the alternative.
- The response of the species to restoration or disturbance, on a population or subpopulation level.

To determine impacts on special-status plant species, the following methods and assumptions were used.

- The following references were consulted to assess potential impacts on special-status plant species in the project area.
  - Rare Plant Inventory Report: Golden Gate National Recreation Area (Faden 2002).
  - Summary of 2003 rare plant surveys in the project area (Taylor 2003).
  - Correspondence on the presence of California bottlebrush (*Elymus californicus*) in the project area (Van Noord 2003).
  - Notes characterizing the dunes in the project area (Shoulders 2003).
  - Plant assessment from the 1994 environmental assessment (Philip Williams & Associates et al. 1994).
  - Map of existing habitat from the 2003 Alternatives Analysis (Philip Williams & Associates et al. 2003).
- The following databases were consulted to identify special-status species that could potentially occur in the project area.
  - The California Natural Diversity Database (CNDDB) (2006) records for the Point Bonita USGS 7.5-minute quadrangle and the following five surrounding quadrangles: San Quentin, San Francisco North, San Francisco South, San Rafael, and Bolinas.
  - *Inventory of Rare and Endangered Plants of California* database records for the above USGS quadrangles (California Native Plant Society 2005).
  - USFWS's (2006) special-status species list for the above USGS quadrangles.
- Field reconnaissance of project construction areas was conducted on January 16, 2005 of the entire project area, including parking lot alternatives by Jones & Stokes biologist Joel Gerwein.

Restoration Alternatives

Table 4.3.2.1-1 summarizes the potential impacts of Restoration Alternatives on vegetation communities and wetlands. The Restoration Alternatives are described in Chapter 2.

Impact VEG-R1: Construction-Related Impacts on Wetland Functioning (Short-Term, Year 0)

See Impacts WQ-R1 through WQ-R6.

Impact VEG-R2: Construction-Related Impacts on Vegetation Communities (Short-Term, Year 0)

Construction activities associated with restoration implementation will involve disturbance of vegetation communities through vegetation clearing activities, grading and installation of restoration features, utility relocation, dewatering activities, and construction and use of access/bypass roads and staging areas for construction equipment, materials and fill. Construction activities could import noxious weed propagules on construction machinery. Extensive ground disturbance and creation of new open areas could result in the colonization of much of the new riparian habitat by Cape ivy and other noxious weeds such as Himalayan blackberry. Harding grass already covers an extensive area at the site and could easily become established in newly exposed areas. Vegetation clearing activities may occur in advance of other restoration actions, increasing the duration of the site disturbance. Disturbance associated with interim flood reduction measures is anticipated to be minimal.

Site disturbance will be minimized to the greatest extent possible by using existing disturbed areas for access roads and staging areas, and concentrating the area of disturbance (based on the restoration design) associated with restoration actions to the minimum necessary to complete the project. Where feasible, temporary measures for access or construction, such as the use of temporary tracks or pads, will be used to minimize impacts. Heavy equipment will be required to be cleaned and weed-free before entering the site. Noxious weed removal would be conducted as part of restoration actions, with the approval of and following the guidelines of GGNRA's Integrated Pest Management Program, reducing the potential for widespread invasion as a result of construction activities. Finally, restoration activities would involve revegetation and other actions to restore ecological function and integrity as rapidly as possible following restoration.

Restoration Alternative 1: Minor adverse. Periodic maintenance dredging activities associated with the No Action alternative would result in only minor amounts of site disturbance.

Restoration Alternative 2: Moderate adverse. The creek Restoration Alternative would involve the least amount of site disturbance of any of the action alternatives. However, while many of the methods cited in the impact discussion above would avoid or minimize construction-related effects on vegetation communities, a substantial degree of site disturbance will be

unavoidable over the 3-year construction period. NPS will take all reasonable measures to avoid or minimize adverse impacts, yet this remains a significant and unavoidable aspect of the restoration action and is necessary to achieve project objectives and implement the restoration design.

The interim flood reduction measures are anticipated to have minimal effects on vegetation communities, and impacts of these actions are considered minor.

Restoration Alternatives 3 and 4: Major adverse. Impacts are similar to those identified under Alternative 2; however, due to the increased duration and extent of site disturbance under these alternatives, impacts are considered major.

The interim flood reduction measures are anticipated to have minimal effects on vegetation communities, and impacts of these actions are considered minor.

Impact VEG-R3: Increase in and Enhancement of Open Water Habitat (Long-Term, Years 5 and 50)

Under all action alternatives, various actions would be taken to improve the areal extent and quality of open water habitats. These include relocation of the Redwood Creek channel to the low point of the valley, which would result in fewer instances of out-of-bank flows and reduced potential for channel avulsion, increasing the persistence of and frequency of wetting and flushing in the active channel. Removal of cement lining in Green Gulch tributaries and the gabions and other channel armoring in Redwood Creek upstream of the existing footbridge would improve open water habitat in these channels by allowing natural erosion and establishment of vegetation in the channel and vegetative filtering of the water flowing through the channel. Increased scour in the new channel would create greater diversity of in-stream habitats (pools, runs, and riffles). Increased bank scour and channel migration would result in increased accumulation of large woody debris in the channel over time. The tidal lagoon would also increase in size because of excavation of emergent wetland at the tidal lagoon's landward edge and increased scour from the creek, and would have increased complexity due to the installation of a LWD structure.

Restoration Alternative 1: Negligible. No actions would be taken that would change the extent or functioning of open water habitats.

Restoration Alternative 2: Moderate Beneficial (Years 5 and 50). The actions common to all action alternatives identified above would result in improved functioning and ecological value of open water systems in the project area. In addition, under this alternative, there would be a small increase in open water habitat (increase of 1.04 acres in Year 5, reducing to an increase of 0.3 acres by Year 50).

Restoration Alternative 3: Major Beneficial (Year 5), Moderate Beneficial (Year 50). The actions common to all action alternatives identified above would result in improved functioning and ecological value of open water systems in the project area. In addition, excavation of the small lagoons would result in 4.3 additional acres of open water habitat in Year 5, reducing to an increase of 0.2

Table 4.3.2.1-1. Potential Vegetation Communities and Wetlands Impacts from Restoration Alternatives

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
VEG-R1: Construction-Related Impacts on Wetland Functioning	See Impacts WQ-R1 through WQ-R6.	See Impacts WQ-R1 through WQ-R6.	See Impacts WQ-R1 through WQ-R6.	See Impacts WQ-R1 through WQ-R6.	
VEG-R2: Construction-Related Impacts on Vegetation Communities	Minor Adverse	**Moderate Adverse/ Moderate Adverse**	**Major Adverse/ Major Adverse**	**Major Adverse/ Major Adverse**	BMPs and avoidance/minimization will be implemented as part of action alternatives; residual impacts unavoidable.
VEG-R3: Increase in and Enhancement of Open Water Habitat	Negligible	Moderate Beneficial	Major Beneficial (Year 5); Moderate beneficial (Year 50)	Major Beneficial	
VEG-R4: Change in Extent and Quality of Emergent Wetland Habitat	Minor Adverse (Year 5); Minor Beneficial (Year 50)	Minor Adverse	**Moderate Adverse (Year 5)** /Minor Adverse (Year 50)	**Moderate Adverse**	Impacts unavoidable as part of alternative design.
VEG-R5: Change in Extent and Quality of Riparian Wetland Habitat	Minor Beneficial	Minor Adverse (Year 5); Major Beneficial (Year 50)	Minor Adverse (Year 5); Moderate Beneficial (Year 50)	**Moderate Adverse (Year 5)**; Minor Beneficial (Year 50)	Significant impacts under Alternative 4 at Year 5 are unavoidable as part of alternative design.
VEG-R6: Increase in Dune Habitat	Negligible	Major Beneficial	Major Beneficial	Major Beneficial	
VEG-R7: Tree Removal	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
VEG-R8: Decreases in Noxious Weed Populations Due to Removal Activities	Negligible	Major Beneficial	Major Beneficial	Major Beneficial	

Table 4.3.2.1-1, Continued

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
VEG-R9: Potential Increase in Noxious Weed Populations Due to Site Disturbance and Changed Groundwater Levels	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
VEG-R10: Increased Lateral and Longitudinal Connectivity Among Channel, Floodplain, Riparian, and Upland Habitats	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	
VEG-R11: Changes in Areal Extent and Functions and Values of USACE-Jurisdictional Waters	Negligible	Minor Adverse (Year 0), Negligible (Year 5), Major Beneficial (Year 50)	Minor Adverse (Year 0), Negligible (Year 5), Major Beneficial (Year 50)	Minor Adverse (Year 0), Negligible (Year 5), Major Beneficial (Year 50)	
VEG-R12: Change in Habitat for Special-Status Plant Species	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	

acres by Year 50. Open water in the small lagoons would provide a high level of habitat, water quality, and hydrologic functioning, because they would be connected to the surrounding wetlands and floodplain. Functioning would improve as adjacent riparian and wetland vegetation on the boundaries of the lagoons matures. The small lagoons would fill with sediment over time, reducing the benefits associated with the increased extent of open water habitat.

Restoration Alternative 4: Major Beneficial (Years 5 and 50). The actions common to all action alternatives identified above would result in improved functioning and ecological value of open water systems in the project area. In addition, excavation of the large lagoon would result in 9.2 additional acres of open water habitat in Year 5. A portion of the big lagoon is expected to fill with sediment by Year 50, but 4.6 acres of additional open water habitat may remain at Year 50. Open water in the big lagoon would provide a high level of habitat, water quality, and hydrologic functioning, because it would be connected to the surrounding floodplain and wetlands. A greater diversity of open water habitat would be present because the big lagoon would be subject to periodic brackish influence, resulting in changing salinity over the course of the year, and variations of salinity within the lagoon at various seasons.

Impact VEG-R4: Change in Extent and Quality of Emergent Wetland Habitat (Long-Term, Years 5 and 50)

Impacts to wetlands under USACE jurisdiction are discussed below under Impact VEG-R11; this impact instead addresses emergent wetlands, which are a vegetation community that is a subset of the USACE-jurisdictional wetlands at the site. Therefore, for this impact discussion, impacts are evaluated using the analysis thresholds for vegetation communities rather than the thresholds for wetlands/waters of the United States.

Existing emergent wetland habitat includes several subhabitats, including brackish marsh in the area between the parking lot and the tidal lagoon, emergent cattails-dominated wetland adjacent to the existing levee road, and seasonal wetland or “wet pasture” habitat in the adjacent Green Gulch pasture. All of these habitats have impaired function: the extent of the brackish marsh is restricted by a remnant retaining wall and is dominated by nonnative Kikuyu grass on the landward side of the wall; the wetland habitat adjacent to the levee road is artificially maintained by a concrete and flashboard weir structure; and the wet pasture is dominated by ruderal species. Therefore, restoration actions are anticipated to generally improve the function of these wetland habitats. In the case of the brackish marsh, the removal of the retaining wall and Kikuyu grass is anticipated to increase the marsh’s areal extent and quality. While the emergent wetland and wet pasture on the east side of the levee road would be largely replaced under all the alternatives (although to a lesser extent under Restoration Alternative 2, which would preserve existing areas used by CRLF), the new wetland habitats that would be constructed in their place are anticipated to have improved hydrologic function and native species composition when compared against the existing artificially maintained cattail marsh and wet pasture. These benefits were weighed against the changed areal extent of emergent wetland habitat when determining impacts. Under all alternatives, a portion of the

brackish marsh that is dominated by native species would be lost as a result of excavation for the tidal lagoon expansion.

Restoration Alternative 1: Minor Adverse (Year 5), Minor Beneficial (Year 50). The removal of a plugged culvert that allowed ponding in the Green Gulch pasture, together with the excavation of a pilot channel downstream of the pedestrian bridge in 2002, has resulted in a lowering of the groundwater table in the Green Gulch pasture. This may result in the gradual loss of some seasonal wetland acreage in this portion of the project area and an eventual conversion to riparian habitat. Under continuance of the No Action Alternative, this could also occur again in the future as a result of future channel excavation activities. Short-term impacts were therefore considered adverse. However, these impacts would be mitigated by the flashboard weir system that was installed in 2003, which has effectively retained water at higher elevations in Green Gulch pasture than in the creek on the other side of the levee.

Over the long term, if maintenance excavations are not sufficient to contain Redwood Creek within a defined channel, avulsion could occur. If creek avulsion occurred, emergent wetlands in the pastures east of the creek could be inundated more frequently and could function as an active floodplain while a new channel establishes. Wetland quality would increase under this scenario because more hydrophytic species would dominate these areas, and productivity would be enhanced by the delivery of nutrients and sediments from sources upstream. Because this scenario is likely, impacts over the long term were considered beneficial.

Restoration Alternative 2: Minor Adverse (Years 5 and 50). This alternative could result in a reduction in the extent of emergent wetland habitat. Based on the maximum anticipated reduction of groundwater elevations, there could be a possible decrease of emergent wetland area of up to 9.9 acres to 3.4 acres at Year 5. The initial decrease may not be as extensive as the maximum possible due to the ability of established populations of cattails to persist over the short term in drier hydrologic regimes. Emergent wetland areas would still be inundated during the winter, allowing them to persist for a longer period. However, over time the growth rate and vigor of cattails in the emergent wetlands will decrease under drier conditions, which may compromise the ability of the emergent wetlands to provide habitat to wildlife species and to filter nutrients and improve water quality. As noted above, a shift from emergent wetland to riparian forest and scrub is not considered in and of itself adverse.

By Year 50, emergent wetland vegetation is unlikely to persist under a drier hydrologic regime and will likely be replaced by riparian forest or scrub vegetation. In addition to the possible loss of 9.9 acres in Year 5, emergent wetland could decrease by up to 0.6 additional acres by Year 50, for a final total of 2.8 acres. However, the long-term decrease in areal extent of emergent wetlands could be reduced by sea level rise. Even a small increase in sea level (0.5 foot) would offset the majority of the groundwater elevation reduction.

The Year 5 and Year 50 losses would be offset by the creation and enhancement of wetlands at other locations on the site. By Year 5, 1.0 ~~1.25~~ acres currently dominated by Kikuyu grass and small areas in the Green Gulch channel and Green Gulch pasture area adjacent to the levee would be enhanced, and 1.58~~0.9~~ acre would be enhanced in Green Gulch pasture. Enhanced wetland acreages are expected to remain the same at Year 50, but transition from emergent wetland to riparian forest and scrub as sediment deposition occurs and groundwater levels drop.

A relatively small amount of emergent wetland habitat loss is associated with expansion of the tidal lagoon and expansion of dune habitat in the brackish marsh area between the tidal lagoon and the parking lot. Depending on the amount of sand accumulation, the Year 50 dune habitat may still function as an emergent wetland.

The majority of acreage lost is associated with the existing emergent wetland in the pasture to the east of the levee road, which would be converted to riparian forest and scrub (with the exception of areas preserved and created for CRLF). This existing emergent wetland is of two basic types: freshwater marsh (near the levee), and seasonal wetlands (the wet pasture habitat described previously). Loss of emergent wetland would be offset to some extent by the excavation of a wetland area adjacent to the Green Gulch tributaries and an additional wetland in the Green Gulch pasture that would provide high-functioning emergent wetland habitat. These excavated wetland areas would occupy approximately 1.58 ~~0.9~~ acre. The wetland area adjacent to Green Gulch and Redwood Creeks would be more hydrologically and geomorphically connected to these creeks than the existing freshwater marsh, improving the natural processes that form and sustain a gradient of wetland types over time. The wetland in Green Gulch pasture would be isolated from the creek channels, providing benefits for certain species of wildlife (e.g., newts and frogs; please refer to section 4.3.2.2, *Wildlife and Wildlife Habitat*). Therefore, a diversity of new wetland habitats would be created to at least partially replace the larger areal extent (but relatively degraded ecological functions and values) of the existing emergent wetlands on the site.

In addition, the removal of the cement lining in Green Gulch tributaries would allow for the establishment of vegetation in these channels, which cover less covering ~~than~~ 0.2 ~~0.1~~ acre, and for the delivery of nutrient and sediment to adjacent wetlands, enhancing their productivity, habitat, and water quality functions. A short-term gain in emergent wetland function is also expected to occur in the 1.0 ~~1.25~~ acre Kikuyu grass-dominated wetland south of the parking lot, due to Kikuyu grass removal, despite the loss of some of this brackish marsh as a result of the excavation for the tidal lagoon and the eventual loss of some of this area due to increased dune formation.

Overall, while the reduction in acreage of emergent wetland habitat is consistent with the criteria for a major adverse impact, the new and restored wetlands at the site are anticipated to have enhanced productivity, habitat and water quality functions compared to the existing wetlands in their degraded condition. This partially offsets the loss in areal extent but would not fully replace the functions

and values of the existing wetlands, despite their existing impaired condition. Furthermore, emergent wetlands will be replaced by riparian forest and scrub, which are also potentially jurisdictional wetlands and provide some of the same functions and values (e.g., plant and wildlife habitat, filtration of nutrients) as emergent wetlands. Overall, adverse impacts are anticipated to be minor given the improved ecological function and the shift to another potential wetland type, but still constitute an unavoidable adverse effect of the restoration action that is necessary to achieve the objectives of this alternative.

Restoration Alternative 3: Moderate Adverse (Year 5), Minor Adverse (Year 50). This alternative would result in a reduction of emergent wetland habitat in the near term, with a decrease of 8.6 acres at Year 5 to 4.7 acres, recovering over the long term by 3.5 acres to an extent of 8.2 acres at Year 50, due to filling in of the lagoons. This would include the loss of emergent wetland associated with the tidal lagoon expansion, as well as the expansion of dune habitat by Year 50. Depending on the amount of sand accumulation, the Year 50 dune habitat may still function as an emergent wetland. The majority of emergent wetland acreage lost is associated with the existing emergent wetland in the pasture to the east of the levee road. Loss of this wetland would be partially offset by the creation of higher-functioning wetland habitat along the fringes of the small lagoons. By Year 50, the small lagoons would be filled to consist almost entirely of emergent wetland habitat.

The emergent wetland areas surrounding the small lagoon by Year 5 and in the filled lagoons by Year 50 would be more hydrologically and geomorphically connected to the Redwood Creek channel than existing wetlands, improving the natural processes that form and sustain a gradient of wetland types over time. The beneficial effect of removing the cement lining in Green Gulch tributaries would be the same as Alternative 2. Anticipated gain of emergent wetland function from restoring the 1.25-acre Kikuyu grass-dominated wetland is the same as Alternative 2, despite the loss of a small portion of this brackish marsh due to excavation for the tidal lagoon.

Overall, while the reduction in acreage of emergent wetland habitat is consistent with the criteria for a major adverse impact, the new and restored wetlands at the site are anticipated to have enhanced productivity, habitat, and water quality functions compared to the wetlands in their existing degraded condition. This partially offsets the loss in areal extent but would not fully replace the functions and values of the existing wetlands, despite their existing impaired condition. Overall, adverse impacts are anticipated to be moderate at Year 5 given the improved ecological function, but still constitute a significant and unavoidable adverse near-term effect of the restoration action that is necessary to achieve the objectives of this alternative. Unlike Restoration Alternative 2, emergent wetland would not be replaced by a different wetland type under Restoration Alternative 3, but by open water and upland dunes, which would not provide similar functions and values. By Year 50, overall impacts are determined to be minor adverse, given improved functioning compared to existing conditions and the partial recovery in areal extent.

Restoration Alternatives 4: Moderate Adverse. This alternative would result in a reduction of emergent wetland habitat, with a decrease of 8.6 acres at Year 5 to 4.7 acres, recovering over the long term by 0.4 acres to an extent of 5.1 acres at Year 50, due to filling in of the lagoon. This would include the loss of emergent wetland associated with the tidal lagoon expansion, as well as the expansion of dune habitat by Year 50. Depending on the amount of sand accumulation, the Year 50 dune habitat may still function as an emergent wetland. The majority of emergent wetland acreage lost is associated with the existing emergent wetland in the pasture to the east of the levee road. This area would be replaced by riparian habitat and open water habitat associated with the lagoon. Loss of the existing acreage would be partially offset by the creation of higher-functioning wetland habitat along the fringes of the new lagoons. By Year 50, a larger portion of the lagoon could become emergent wetland, but the conversion of emergent wetland to riparian vegetation in other parts of the Green Gulch pasture would persist. As noted above, riparian vegetation may provide some of the same functions and values associated with emergent wetland.

Functioning of emergent wetland systems at the site would improve, similar to the wetland enhancement that would occur under Alternative 3. However, a smaller area of emergent marsh would form than under that alternative. The beneficial effect of removing the cement lining in Green Gulch tributaries would be the same as Alternatives 2 and 3. Potential gain of emergent wetland function from restoring the 1.0 ~~1.25~~ acre Kikuyu grass-dominated wetland would be the same as Restoration Alternatives 2 and 3, despite the loss of some of this brackish marsh as a result of the excavation for the tidal lagoon.

Overall, while the reduction in acreage of emergent wetland habitat is consistent with the criteria for a major adverse impact, the new and restored wetlands at the site are anticipated to have enhanced productivity, habitat and water quality functions compared to the existing wetlands in their degraded condition. This partially offsets the loss in areal extent but would not fully replace the functions and values of the existing wetlands, despite their existing impaired condition. Overall, adverse impacts are anticipated to be moderate given the improved ecological function, but still constitute a significant and unavoidable adverse effect of the restoration action that is necessary to achieve the objectives of this alternative.

Impact VEG-R5: Change in Extent and Quality of Riparian Wetland Habitat (Long-Term, Year 5 and 50)

Restoration Alternative 1: Minor Beneficial. Continued inundation of the Alder Grove area upstream of Pacific Way would continue to stress alders and prevent their recovery. Many alders have died due to prolonged inundation. However, reduced groundwater levels at the site are anticipated to result in a long-term trend towards riparian vegetation, resulting in minor beneficial impacts overall.

Restoration Alternative 2: Minor Adverse (Year 5), Major Beneficial (Year 50). At Year 5, riparian wetland extent would be increased substantially from 13.2 acres to a possible maximum 21.1 acres; however, much of this riparian

wetland would be new riparian habitat, and there would be a net reduction in mature riparian habitat by about 2.7 acres. Most of the lost mature riparian habitat would be located immediately downstream of Pacific Way, where it would be removed as a result of construction activities (e.g., channel relocation, construction and removal of the bridge bypass road) and replanted following construction. An active revegetation program will be conducted to allow for rapid recovery of the new riparian habitat, including the use of such fast-growing species as willows and cottonwoods, as well as slower-growing species such as alders. Habitat functioning of this community (e.g., shading, bird habitat) would be somewhat limited due to the relatively smaller stature of trees and the absence of snags and dead branches. Over time, habitat value would improve as the riparian habitat matures, and a large increase in the areal extent of fully functioning riparian vegetation (to 21.6 acres) would occur at the site.

Restoration Alternative 3: Minor Adverse (Year 5), Moderate Beneficial (Year 50). At Year 5, riparian habitat extent would be increased from 13.2 acres to 16.9 acres; however, much of this riparian habitat would be new riparian habitat, and there would be a net reduction in mature riparian forest by about 2.3 acres. Most of the lost mature riparian habitat would be located immediately downstream of Pacific Way, where it would be removed as a result of construction activities (e.g., channel relocation, construction and removal of the bridge bypass road) and replanted following construction. An active revegetation program will be conducted to allow for rapid recovery of the new riparian habitat, including the use of such fast-growing species as willows and cottonwoods, as well as slower-growing species such as alders. Habitat functioning of this community (e.g., shading, bird habitat) would be somewhat limited due to the relatively smaller stature of trees and the absence of snags and dead branches. Over time, habitat value would improve as the riparian habitat matures, and an increase in the areal extent of fully functioning riparian vegetation (to 16.3 acres) would occur at the site.

Restoration Alternatives 4: Moderate Adverse (Year 5), Minor Beneficial (Year 50). At Year 5, riparian habitat extent would be decreased from 13.2 acres to 12 acres; in addition, much of this riparian habitat would be new riparian habitat, and there would be a net reduction in mature riparian habitat by about 5.4 acres. The lost mature riparian habitat would be primarily located in two places—(1) immediately downstream of Pacific Way, where it would be removed as a result of construction activities (e.g., channel relocation, construction and removal of the bridge bypass road) and replanted following construction; and (2) in the area immediately north of the existing parking lot, where it would be removed and replaced by the new lagoon feature. An active revegetation program will be conducted to allow for rapid recovery of the new riparian habitat, including the use of such fast-growing species as willows and cottonwoods, as well as slower-growing species such as alders. Habitat functioning of this community (e.g., shading, bird habitat) would be somewhat limited due to the relatively smaller stature of trees and the absence of snags and dead branches. Over time, habitat value would improve as the riparian habitat matures, and a small increase in the areal extent of fully functioning riparian vegetation (to 15 acres) would occur at the site. The loss of riparian extent and

function at Year 5 is considered a significant and unavoidable aspect of the restoration action that is necessary to achieve the objectives of this alternative.

Impact VEG-R6: Increase in Dune Habitat (Long-Term, Years 5 and 50)

Under the action alternatives, native dune communities would be expanded and increased in quality by enhancing dune processes between the existing parking lot and tidal lagoon. Dune enhancement would be a result of natural lowering of the water table following excavation of a more appropriate channel alignment to the tidal lagoon, combined with wind activity to develop dunes from newly dry (hence, erodible) sands. Dunes are most likely to form toward the southeast end of the beach, due to the direction of prevailing winds. Fencing and other means of restricting public access would reduce human and animal trampling, allowing reestablishment of vegetation on the foredunes, to the south or ocean-side of the existing backdune lobes. With establishment of native foredune vegetation, the foredunes are anticipated to capture fine sand, thereby reducing the sand washed or blown into the new channel.

Restoration Alternative 1: Negligible. No increase in dune habitat is anticipated.

Restoration Alternative 2, 3, 4: Major Beneficial. An increase of 0.6 acres (6 times the current dune extent of 0.1 acres) is expected due to dune restoration activities at Year 5, increasing to a total extent of 2.1 acres by Year 50 as a result of the actions identified above. Depending on the amount of sand accumulation, portions of the Year 50 dune habitat could still function as an emergent wetland. Due to the limited extent and degraded nature of the existing dunes at the site, this expansion is considered to be a major beneficial impact.

Impact VEG-R7: Tree Removal (Long-Term, Years 0, 5 and 50)

Effects related to removal of trees from the riparian habitat have been discussed above under Impact VEG-R5. In addition, all action alternatives would involve removal of a windrow of Monterey cypress trees on the southwest edge of Green Gulch Field 7. While these trees may provide some habitat value, they do not represent a significant portion of the trees found on the site and in nearby areas, and they would be replaced with more natural and highly functioning habitat.

Restoration Alternative 1: Negligible. No tree removal would be expected to occur under this alternative.

Restoration Alternative 2, 3, 4: Minor Adverse.

Impact VEG-R8: Decreases in Noxious Weed Populations Due to Removal Activities (Long-Term, Years 5 and 50)

All action alternatives involve removal of invasive nonnative plant species. In particular, Cape ivy and nonnative invasive perennial grasses, such as Kikuyu grass, Harding grass, and tall fescue would be removed from various locations at the project site. Nonnative species outside the project boundary that would be likely to spread to the project site would also be targeted for removal, particularly

the Harding grass in the alluvial fan south of the project boundary. Himalayan blackberry and other nonnatives would also be targeted for removal.

Cape ivy removal would be prioritized in the approximately 6- to 7-acre alder grove upstream of Pacific Way. The Green Gulch tributary portion would also be included as part of this first phase. The second priority would be removal in the riparian area adjacent to the parking lot, since this area could be contained temporarily, preventing reestablishment. While an intensive invasive species removal effort is expected during early phases of the project, ongoing invasive species management through Integrated Pest Management (IPM) techniques is anticipated through the lifetime of the project.

In addition, during construction, Kikuyu grass would be excavated to rooting depth (approximately 1 foot) at locations where it occurs at the project site, particularly shoreward of the existing parking lot and at the intersection of Green Gulch Trail and the existing levee road, along the levee road, and at more isolated locations around the edges of the site.

Restoration Alternative 1: Negligible. Noxious weed removal activities would be expected to be minimal.

Restoration Alternative 2, 3, 4: Major Beneficial. The active removal of noxious weeds would greatly reduce noxious weed populations at the project site, allowing for increased establishment of native vegetation and an increase in native species diversity and abundance, and increased ecosystem integrity and function.

Impact VEG-R9: Potential Increase in Noxious Weed Populations Due to Site Disturbance and Changed Groundwater Levels (Long-Term, Years 5 and 50)

In general, reduced groundwater levels associated with the various action alternatives are anticipated to result in a trend towards drier riparian environments, which are favorable for invasion by certain species such as Cape ivy and Himalayan blackberry. Ongoing weed management activities over the lifetime of the project are anticipated to ensure that invasive plants are maintained at minimal levels.

In addition, creation of habitats such as emergent wetland and open water environments could lead to invasion by aquatic weeds; the invasive, nonnative aquatic weed Brazilian waterweed are known to occur at the Zendo Pond on Green Gulch Farm, providing a potential vector for such invasion. Brazilian waterweed could potentially become established in a restored lagoon.

Restoration Alternative 1: Minor Adverse. No major ground disturbances would occur in vegetated areas. Therefore, there would be no substantial new opportunities for the expansion of noxious weeds, apart from continued expansion of those populations currently present. Invasion may be favored due to lowered groundwater levels from channel excavation and the trend towards riparian vegetation and associated invasive species. In addition, channel avulsion,

if it were to occur, could create a disturbance allowing for colonization by noxious species.

Restoration Alternative 2: Minor Adverse. Alternative 2 would result in the most riparian habitat of any action alternative. Because most noxious weeds in the project vicinity are associated with riparian habitat, the potential spread of noxious weeds is greatest under this alternative. Cape ivy could lead to the mortality of riparian vegetation and/or reduce its use by wildlife. In addition, the threat of aquatic weeds is possible for open water and newly excavated emergent wetland areas. Active weed control activities are anticipated to ensure that this impact remains minor.

Restoration Alternative 3: Minor Adverse. Impacts would be similar to Alternative 2. While the riparian area where noxious weeds are likely to establish would be of smaller extent, the open water habitat of the small lagoons would be subject to invasion by noxious aquatic species. Active weed control activities are anticipated to ensure that this impact remains minor.

Restoration Alternative 4: Minor Adverse. Impacts would be similar to Alternative 3. While the riparian area where noxious weeds are likely to establish would be of smaller extent, the open water habitat of the large lagoon would be subject to invasion by noxious aquatic species. Active weed control activities are anticipated to ensure that this impact remains minor.

Impact VEG-R10: Increased Lateral and Longitudinal Connectivity Among Channel, Floodplain, Riparian, and Upland Habitats (Long-Term, Years 5 and 50)

All action alternatives provide increased connectivity among wetland and aquatic habitats. Removal of the levee road, relocation of the channel to the pastures east of the existing channel, and removal of fill in the picnic area and in the emergent wetland south of the parking lot would improve lateral connectivity among channel, floodplain, and riparian habitats. Removal of the concrete lining of the Green Gulch tributaries, removal of gabions and armoring in Redwood Creek, replacement of culvert connections between Redwood Creek and tributaries with unculverted connections, and removal of the concrete weir structure would improve longitudinal connectivity along these channels. Design of the channel to allow for more frequent out-of-bank flows would allow for improved floodplain function in the area.

Restoration Alternative 1: Negligible. No increase in connectivity of the channel and adjacent habitats is expected.

Restoration Alternative 2, 3, 4: Moderate Beneficial. Alternatives 2, 3, and 4 all provide increased connectivity among wetland and aquatic habitats.

Impact VEG-R11: Changes in Areal Extent and Functions and Values of USACE-Jurisdictional Waters (Long-Term, Years 5 and 50)

As discussed in the *Affected Environment* chapter, of the 41 acres on the project site that have been delineated, 26.5 acres were determined by the USACE to be

jurisdictional wetlands and 2.6 acres were determined to be other waters of the United States. Jurisdictional waters on the site include open water habitats (including tidal/estuarine, brackish, and freshwater components), emergent wetland (including brackish marsh, cattail-dominated wetland, and wet pasture), and riparian wetland. Areas not potentially jurisdictional consist of developed features (e.g., Pacific Way, the parking lot, and the levee road) or upland areas.

Existing wetland functions and values are considered impaired at the site for a variety of reasons, including: historic land use practices in the watershed above the project site, which have elevated sediment delivery and resulted in increased aggradation and the filling in of lagoon features that were historically present at the site; the channelization of Redwood Creek and the existing Pacific Way bridge along the side of the valley rather than in its historic low point, which prevents natural floodplain and geomorphic function; a history of agriculture, grazing, and other human-induced disturbances, which has degraded the habitat qualities at the site and led to the invasion by nonnative plant species such as Harding grass and Kikuyu grass; and the artificial nature of the emergent wetland adjacent to the levee road, maintained by a concrete and flashboard weir structure.

In general, the Restoration Alternatives do not involve substantial net changes in the areal extent of features that are potentially jurisdictional; rather, each Restoration Alternative changes the mosaic of habitat types, with each alternative having different mixes of open water, emergent wetland, and riparian habitats. Construction activities could result in the temporary loss of wetland acreage, as a result of construction of access roads, etc.; however, these areas would be returned to their original condition once construction is complete. Following construction, there would be an initial period of ecosystem establishment when restored portions of the ecosystem would have somewhat reduced function and value. However, the ecosystem is anticipated to be functionally established after 5–10 years, and at this time all action alternatives would provide for improved functions and values of the potentially jurisdictional waters on the site. This would occur through a variety of means, including more natural geomorphic evolution of the stream channel, improved floodplain connectivity, reductions in nonnative species, increase in habitat and potential richness/abundance of native species, improved fish passage, improved nutrient cycling, and others benefits that have been captured in the impact discussion above.

Restoration Alternative 1: Negligible. No actions are anticipated to be taken that would change the areal extent or functions and values of wetlands at the project site.

Restoration Alternative 2, 3, 4: Minor Adverse (Year 0), Negligible (Year 5), Major Beneficial (Year 50). Under all alternatives, the most likely areas that could be converted from jurisdictional to non-jurisdictional status are the restored dune habitats in the brackish marsh area, which would expand from 0.1 acres to 2.1 acres under all action alternatives. The expansion of dune scrub habitat is predicted based on the lowering of groundwater levels, resulting in the influx of newly dry, hence erodible, sand, and the removal of nonnative vegetation and

debris. However, this is a conservative assumption, and portions of the dunes, specifically low-lying areas, may still support wetland vegetation and be considered jurisdictional. Under all alternatives, the 1,300 foot–long levee will be removed, adding about 0.33 acres as new jurisdictional wetland. While no jurisdictional area is expected to be lost due to restoration actions, in order to ensure that the Final EIS/EIR considers the greatest possible loss of wetlands, for the purposes of this Final EIS/EIR, it is assumed that between 0 and 2.5 acres of jurisdictional features would be naturally converted to non-jurisdictional habitat under any of the alternatives.

While this extent of conversion is consistent with the acreage threshold for a minor to moderate adverse impact, it is greatly outweighed by what is anticipated to be a highly noticeable, widespread improvement in ecological functions and values, consistent with a major beneficial impact. This distinct improvement in the currently degraded nature of the existing jurisdictional waters at the site results in a conclusion that there would be major beneficial impacts to jurisdictional waters under all action alternatives. Construction-related effects on functions and values are considered less than significant due their short duration. Impacts are considered negligible during the early phase of ecosystem establishment. Major beneficial effects would be experienced for the majority (approximately 40 of 50 years) of the project lifetime.

Impact VEG-R12: Change in Habitat for Special-Status Plant Species (Long-Term, Years 5 and 50)

As described in Chapter 3, *Affected Environment*, no special-status plant species are known to occur at the project site. NPS would conduct surveys prior to construction to confirm this and avoid potential construction-related effects.

A variety of special-status plant species, associated with various habitat types, may have historically occurred at the site. Of these, two plant species ranked by the CNPS as List 4 (Watch List[1]) species have been found in the hills near Muir Beach—California bottle-brush grass and San Francisco wallflower. California bottlebrush is associated with riparian habitat, and San Francisco wallflower is associated with coastal dune habitat. Restoration actions that increase the areal extent or reduce nonnative species cover in target habitats could increase the potential for special-status species to colonize the project area. In addition, revegetation programs by NPS could result in recolonization of the site by special-status species.

Restoration Alternative 1: Minor Beneficial. Habitat for California bottlebrush grass could expand as decreased groundwater levels resulting from channel excavation activities lead to riparian habitat recovery.

[1] California Native Plant Society (CNPS) List 4 (Watch List) species are limited in their distribution or uncommon throughout a broad area in California. Their vulnerability appears relatively low at this time. CNPS does not consider these plants “rare” from a statewide perspective, but considers them to be sufficiently uncommon to justify regular monitoring of their status.

Restoration Alternative 2, 3, 4: Minor Beneficial. Coastal dune habitat for San Francisco wallflower would expand under Alternatives 2, 3, and 4 (see Impact VEG-R6). Riparian habitat for California bottlebrush would expand under these alternatives, although the extent of this expansion differs by alternative (see Impact VEG-R2). However, because these species are not known to occur on the site, it is considered speculative whether they would colonize the site after restoration; for this reason, benefits are considered minor.

Public Access Alternatives

Table 4.3.2.1-2 summarizes the potential impacts of Public Access Alternatives on vegetation communities and wetlands. The Public Access Alternatives are described in Chapter 2.

Impact VEG-P1: Construction-Related Impacts on Wetland Functioning (Short-Term, Year 0)

See Impacts WQ-P1 through WQ-P2.

Impact VEG-P2: Construction-Related Impacts on Vegetation Communities (Short-Term, Year 0)

Impact mechanisms would be similar to those described under Impact VEG-R2, and could arise from construction activities related to parking lot reconfiguration, relocation of the picnic area, construction of new visitor facilities at the beach, the new pedestrian trail from Hwy 1 to the parking lot, the new pedestrian trail and bridge from the parking lot to the beach, the construction of new trails and interpretive displays, and upgrades to the perimeter road to provide emergency access. Fill for the picnic area would be relocated adjacent to the new parking lot, but its overall footprint would be 25 to 50% smaller than the existing picnic area, adding between about 0.04 and 0.09 acres of jurisdictional wetland. Existing disturbed areas adjacent to the relocated parking lot, such as those dominated by Kikuyu grass, would be prioritized as new locations for the picnic area. The location of impacts of the new trail/bridge to the beach would vary depending upon the selection of a final location, and could affect the riparian wetland in the vicinity of the existing footbridge, the brackish wetland between the existing parking lot and tidal lagoon, and/or Redwood Creek or the upper portion of the tidal lagoon itself should the ultimate route cross the lagoon.

Public Access Alternative A: Negligible. No construction-related impacts would result from leaving the parking lot in its current configuration.

Public Access Alternative B1–B5, C: Minor Adverse. The reconfigured/relocated parking lots under these alternatives would involve disturbance of some mature riparian habitat. The removal of portions of the existing lot would create the potential for new disturbed areas, but they would be revegetated with riparian species as soon as possible after disturbance. Impacts are considered minor adverse.

Table 4.3.2.1-2. Potential Vegetation Communities and Wetlands Impacts from Public Access Alternatives

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
VEG-P1: Construction-Related Impacts on Wetland Functioning	See Impacts WQ-P1 and WQ-P2.	See Impacts WQ-P1 and WQ-P2.	See Impacts WQ-P1 and WQ-P2.	See Impacts WQ-P1 and WQ-P2.	See Impacts WQ-P1 and WQ-P2.	See Impacts WQ-P1 and WQ-P2.	See Impacts WQ-P1 and WQ-P2.	
VEG-P2: Construction-Related Impacts on Vegetation Communities	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
VEG-P3: Change in Extent and Quality of Riparian Habitat	Negligible	Moderate Beneficial	Minor Beneficial	Minor Adverse (Year 5); Negligible (Year 50)	Moderate Adverse (Year 5); Negligible (Year 50).	Moderate Adverse	Negligible	
VEG-P4: Impacts on the Quality of Riparian and Wetland Habitat from Visitor Use	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	Negligible	Minor Adverse	Minor Adverse	
VEG-P5: Increase in Area of Wetland Swales	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	
VEG-P6: Tree Removal	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
VEG-P7: Increase in Noxious Weed Populations from Visitors	Negligible	Minor Beneficial	Minor Beneficial	Negligible	Negligible	Minor Adverse	Minor Beneficial	
VEG-P8: Changes in Areal Extent and Functions and Values of USACE-Jurisdictional Waters	Negligible	Minor Beneficial	Minor Beneficial	Minor Adverse	Minor Adverse	Moderate Adverse	Minor Adverse	
VEG-P9: Change in Habitat for Special-Status Plant Species	Negligible	See Impact VEG-P3.	See Impact VEG-P3.	See Impact VEG-P3.	See Impact VEG-P3.	See Impact VEG-P3.	See Impact VEG-P3.	

Exhibit 2: Final Environmental Impact Statement

Impact VEG-P3: Change in Extent and Quality of Riparian Habitat (Long-Term, Years 5 and 50)

Existing riparian habitat in the vicinity of the existing parking lot, at the Alder Grove, and along the alignment of the new pedestrian path from Hwy 1 is relatively mature, dense, and is believed to have a high degree of ecological function, including amenities such as nutrient cycling, shading and bird habitat. The pedestrian path would remove some of this vegetation. The larger parking lot alternatives would remove or replace portions of the existing riparian habitat, while the smallest alternative would simply result in a net increase in riparian habitat. While an active revegetation program will be conducted to allow for rapid recovery of the new riparian habitat, habitat functioning of this community (e.g., shading, bird habitat) would be limited in the near term due to its small stature and the absence of snags and dead branches. Over the long term, the new riparian vegetation would become mature and provide replacement ecological function and/or additional function in the case of a net increase in riparian extent.

Public Access Alternative A: Negligible. No changes to riparian extent or function would result from leaving the parking lot in its current configuration.

Public Access Alternative B1: Moderate Beneficial. The reconfigured parking lot under this alternative would be located within the footprint of the existing parking lot. The removal of the remainder of the existing lot would create approximately 0.9 acres of new riparian habitat. This would be offset somewhat by construction of the pedestrian trail, which would remove approximately 0.25 ~~0.15~~ acres of mature riparian habitat. Overall, there would be a net increase in riparian area of approximately 0.65 ~~0.75~~ acres, which is considered a moderate beneficial impact.

Public Access Alternative B2: Minor Beneficial. Impacts associated with this alternative would be similar to those described for Public Access Alternative B1. However, the creation of new riparian acreage would be only about 0.32 acres. The overall increase in riparian habitat would be approximately 0.07~~0.17~~ acres (including the losses of mature riparian habitat associated with the pedestrian trail). Impacts are considered minor beneficial.

Public Access Alternative B3: Minor Adverse (Year 5); Negligible (Year 50). The reconfigured parking lot under this alternative would provide some areas of new riparian habitat (~0.40 acres) due to removal of the lower 90 feet of the existing lot. The lot would be about the same size as the footprint of the existing parking lot, but its expansion into the adjacent riparian area would result in the loss of approximately 0.85 ~~0.75~~ acres of mature riparian habitat (including the pedestrian trail). There would be a loss of approximately 0.45 ~~0.25~~ acres of riparian habitat overall, primarily due to the new pedestrian trail, which is considered a minor adverse impact. As many riparian trees as possible will be retained along the route of the trail.

Public Access Alternative B4: Moderate Adverse (Year 5); Negligible (Year 50). The reconfigured parking lot under this alternative would partially overlap with the footprint of the existing parking lot, but would also result in the loss of a

portion of the mature riparian habitat to the north of the existing parking lot along Pacific Way (~1.18~~1.24~~ acres including the pedestrian trail). Removal of the remainder of the existing lot and picnic area would allow for new riparian vegetation, which would have limited habitat value in the near term but would quickly mature (~~~~0.9 acre~~s~~). The rotation of the parking lot is anticipated to allow for improved riparian floodplain functions by being parallel with flow in Redwood Creek. The short-term loss of over 1 acre of mature riparian habitat is considered a moderate but less-than-significant adverse impact at Year 5. The gain in floodplain function from rotating the lot balances against the loss of 0.28~~0.34~~ acres of riparian habitat over the long term, resulting in a negligible impact at Year 50.

Public Access Alternative B5: Minor Adverse. The expanded parking lot under this alternative would partially overlap with the footprint of the existing parking lot, but would also result in the loss of a portion of the mature riparian habitat to the north of the existing parking lot along Pacific Way (~1.13~~1.03~~ acres, including the pedestrian trail). Removal of the remainder of the existing lot would allow for new riparian vegetation, which would have limited habitat value in the near term but would quickly mature (~0.32 acres). The overall loss of approximately 0.81~~0.71~~ acres of riparian habitat is considered a moderate but less-than-significant adverse impact.

Public Access Alternative C: Negligible. Under this alternative, approximately 1.28~~1.18~~ acres of mature riparian habitat would be lost at the Alder Grove and as a result of the new pedestrian trail. The removal of the existing lot at the beach would result in the gain of 0.97 acres of new riparian habitat. The short-term loss of over 1 acre of mature riparian habitat is considered a moderate but less-than-significant adverse impact at Year 5. The overall loss of 0.31~~0.21~~ acres of riparian habitat over the long term is considered a minor adverse impact.

Impact VEG-P4: Impacts on the Quality of Riparian and Wetland Habitat from Visitor Use (Long-Term, Years 5 and 50)

Disturbance of riparian and emergent wetlands adjacent to the parking lot and other public access facilities (e.g., picnic area and trails) may result from visitor use. This can include habitat degradation through trampling, flushing of birds or nest abandonment, trash, human and pet waste, as well as contaminants from vehicles.

Public Access Alternative A: Negligible. Riparian and emergent wetlands adjacent to the current parking lot would continue to be affected by human disturbance and runoff containing sediment from the parking lot and hydrocarbons from vehicles.

Public Access Alternative B1: Minor Beneficial. Riparian habitat adjacent to the existing parking lot would be buffered from the parking lot and therefore benefit from reduced human disturbance and parking lot runoff. Restored emergent wetland and riparian habitat that would be adjacent to the new parking lot would benefit from reduced contaminants in parking lot runoff due to the effect of wetland swales.

Public Access Alternative B2: Minor Beneficial. While the footprint of the parking lot would be similar to the existing condition, emergent wetland and riparian habitat that would be adjacent to the parking lot would benefit from reduced contaminants in parking lot runoff due to the effect of wetland swales.

Public Access Alternative B3: Minor Beneficial. While the expanded size of the parking lot could expose new riparian areas to disturbance, emergent wetland and riparian habitat that would be adjacent to the parking lot would benefit from reduced contaminants in parking lot runoff due to the effect of wetland swales.

Public Access Alternative B4: Negligible. The expanded size of the parking lot could expose new riparian areas to disturbance to an extent that is similar to but greater than Public Access Alternative B3. Emergent wetland and riparian habitat that would be adjacent to the parking lot would benefit from reduced contaminants in parking lot runoff due to the effect of wetland swales. Overall effects are anticipated to be negligible.

Public Access Alternative B5: Minor Adverse. The expanded size of the parking lot could expose new riparian areas to disturbance to an extent that is similar to, but greater than, Public Access Alternative B4. Emergent wetland and riparian habitat that would be adjacent to the parking lot would benefit from reduced contaminants in parking lot runoff due to the effect of wetland swales. Overall, this alternative is anticipated to have minor adverse impacts due to the increased exposure of riparian area to human disturbance.

Public Access Alternative C: Minor Adverse. The relocation of the parking lot and additional segment of the pedestrian trail would expose a new area of riparian habitat to human disturbance. Emergent wetland and riparian habitat that would be adjacent to the parking lot would benefit from reduced contaminants in parking lot runoff due to the effect of wetland swales. Overall, this alternative is anticipated to have the greatest adverse impacts due to the increased exposure of new riparian areas to human disturbance.

Impact VEG-P5: Increase in Area of Wetland Swales (Long-Term, Years 5 and 50)

All the Public Access Alternatives include the installation of dense native tree cover and/or native herbaceous vegetation in 5 foot–wide planting bays, or swales, between the rows of parking and in planting islands separating groups of vehicles. While these would be habitats subject to regular disturbance and hence would not provide high levels of habitat value or ecological function, they could provide some small level of habitat value and would potentially provide some filtering capacity for the parking lot, reducing potential effects on adjacent riparian and emergent wetland habitats. Because it is unclear whether these swales would develop the characteristics necessary to qualify as jurisdictional wetlands, they are not being considered as jurisdictional wetlands for the purposes of this Final EIS/EIR.

Public Access Alternative A: Negligible. No wetland swales would be added.

Public Access Alternative B1: Minor Beneficial. Increase of 1,485 square feet of wetland swales in long bays and end bays.

Public Access Alternative B2: Minor Beneficial. Increase of 3,660 square feet of wetland swales.

Public Access Alternative B3: Minor Beneficial. Increase of 3,845 square feet of wetland swales.

Public Access Alternative B4: Minor Beneficial. Increase of 3,910 square feet of wetland swales.

Public Access Alternative B5: Minor Beneficial. Increase of 13,080 square feet of wetland swales.

Public Access Alternative C: Minor Beneficial. Increase of 3,275 square feet of wetland swales.

Impact VEG-P6: Tree Removal (Long-Term, Years 0, 5 and 50)

Effects related to removal of trees from riparian areas have been discussed above under Impact VEG-P3. In addition, all action alternatives potentially involve removal of one Monterey Pine that is at the corner of Pacific Way and Hwy 1 to provide for the pedestrian trail. In addition, two of the pines lining Pacific Way would be removed for a new entry to Public Access Alternative B4. While these trees may provide some habitat value, they do not represent a significant portion of the trees found at the site.

Public Access Alternative A: Negligible. No tree removal would be expected to occur under this alternative.

Public Access Alternatives B1, B2, B3, B4, B5 and C: Minor Adverse.

Impact VEG-P7: Increase in Noxious Weed Populations from Visitors (Long-Term, Years 5 and 50)

Changes in visitation patterns engendered by changes in parking lot capacity and other public access amenities could alter the potential for noxious weed invasions by visitors. Impacts include potential introduction of weed propagules, as well as human disturbance that could lead to colonization by weeds.

Public Access Alternative A: Negligible. No new sources of noxious weed propagules or opportunities for colonization would result from leaving the parking lot in its current configuration.

Public Access Alternative B1, B2: Minor Beneficial. Reducing the availability of parking in the project area would reduce the number of visitors somewhat, which would likely reduce the number of propagules of noxious weeds reaching the project area.

Public Access Alternative B3, B4: Negligible. Parking capacity would remain as under baseline conditions, resulting in similar potential for noxious weed introduction.

Public Access Alternative B5: Minor Adverse. Increased parking capacity could result in slightly increased potential for visitors to introduce noxious weeds.

Public Access Alternative C: Minor Beneficial. Same as Alternatives B1 and B2.

Impact VEG-P8: Changes in Areal Extent and Functions and Values of USACE-Jurisdictional Waters (Long-Term, Years 5 and 50)

Impact VEG-R11 previously discussed the extent of potential jurisdictional wetlands and other waters of the United States. Potentially jurisdictional waters that could be affected by the Public Access Alternatives are composed almost entirely of riparian wetland (adjacent to the pedestrian path from Hwy 1 and the parking lot), with small potential for effects on open water or emergent wetland habitat where the pedestrian bridge to the beach crosses Redwood Creek.

All action alternatives would involve the loss of some areal extent of jurisdictional features associated with the pedestrian pathway from Hwy 1; the area associated with the path has been calculated at approximately 0.25~~0.15~~ acre. Public Access Alternative C would involve an additional segment to connect the trail from the Alder Grove parking lot to Pacific Way, consisting of another 0.07 acres.

The pedestrian path and bridge from the beach parking lot/turnaround would replace the existing path, and is expected to result in minimal or no net loss of jurisdictional features.

A picnic area is proposed adjacent to the parking lot. Although the design of the picnic area under each alternative has not been finalized, the picnic area would be designed to avoid any net loss of jurisdictional wetlands or waters, and sited to minimize any other potential wetland impacts. Fill from the existing picnic area will be removed and replaced in a new layout adjacent to the newly relocated parking lot, but its overall size will be 25 to 50% smaller than the existing picnic area, resulting in a minor increase in jurisdictional area of between about 0.04 and 0.09 acres.

The parking lots would result in either an increase or decrease in jurisdictional features depending upon the footprint of the lot.

The precise amount of both temporary and permanent gain or loss of jurisdictional waters will need to be determined once detailed site plans have been completed. However, in all cases, losses associated with the Public Access Alternatives are anticipated to be small (<1 acre), and would be within the overall project maximum of 2.5 acres discussed in Impact VEG-R11 above. They are also at least partially offset by the increase in function and value associated with

the removal of the end of the existing parking lot, which would allow for improved natural geomorphic evolution of the stream channel, improved floodplain connectivity and hydraulic conveyance, and other similar benefits. This is particularly the case for the smallest parking lot (B1) and the parking lot rotated parallel to the flow of Redwood Creek (B4), which would be further from the active channel of Redwood Creek.

Finally, any losses in areal extent of jurisdictional waters associated with the Public Access Alternatives are overshadowed by the improved ecological functioning, integrity and sustainability of the restoration project as a whole. Because implementing one of the Public Access Alternatives is a necessary component of the overall restoration, considering these factors in combination is appropriate.

Public Access Alternative A: Negligible. No actions are anticipated to be taken that would change the areal extent or functions and values of wetlands at the project site.

Public Access Alternative B1: Minor Beneficial. The reduced size of this parking lot, when considered in combination with other public access features, is anticipated to result in an increase in jurisdictional waters of approximately 0.72~~0.75~~ acres when compared to Public Access Alternative B4. Note that the size of this parking lot is anticipated to provide improved hydraulic conveyance, geomorphic evolution, and floodplain function.

Public Access Alternative B2: Minor Beneficial. The reduced size of this parking lot, when considered with other public access features, is anticipated to result in an increase in jurisdictional waters of approximately 0.26~~0.17~~ acres.

Public Access Alternative B3: Minor Adverse. This parking lot will be approximately the same size as the existing parking lot, and the picnic area is expected to be smaller than the existing parking lot, but there will be a net loss in jurisdictional waters of approximately 0.28~~0.25~~ acres due to the new trail from Hwy 1.

Public Access Alternative B4: Minor Adverse. The increased size of this parking lot, when considered in combination with other public access features, is anticipated to result in a loss in jurisdictional waters of approximately 0.33~~0.34~~acres. The rotated configuration of this parking lot is anticipated to provide improved hydraulic conveyance, geomorphic evolution, and floodplain function; impacts are considered minor adverse overall.

Public Access Alternative B5: Moderate Adverse. The increased size of this parking lot, when considered in combination with other public access features, is anticipated to result in a decrease in jurisdictional waters of approximately 0.47~~0.71~~ acres. The overall loss of approximately 0.81~~0.71~~ acres of riparian habitat is considered a moderate but less-than-significant adverse impact.

Public Access Alternative C: Minor Adverse. The increased size of this parking lot, when considered in combination other public access features, is anticipated to result in a decrease in jurisdictional waters of approximately 0.04~~0.21~~ acres.

Impact VEG-P9: Change in Habitat for Special-Status Plant Species (Long-Term, Years 5 and 50)

As previously described, no special-status plant species are known to occur at the project site. NPS would conduct surveys prior to construction to confirm this and avoid potential effects. California bottlebrush grass could occur in the riparian habitats potentially affected by the Public Access Alternatives. Actions that increase the areal extent of this habitat could increase the potential for this and other riparian-associated special-status species to colonize the project area. In addition, out-planting programs by NPS could result in recolonization of these areas by special-status species.

Public Access Alternative A: Negligible. No loss of riparian habitat would result from leaving the parking lot in its current configuration.

Public Access Alternative B1, B2, B3, B4, B5 and C: See Impact VEG-P3. Potential effects on riparian-associated special-status plant species would correspond to the extent of riparian habitat gained or lost from each Public Access Alternative. Impact determinations would be as described for Impact VEG-P3.

Bridge Alternatives

Table 4.3.2.1-3 summarizes the potential impacts of Bridge Alternatives on vegetation communities and wetlands in the study area. The Bridge Alternatives are described in Chapter 2.

Table 4.3.2.1-3. Potential Vegetation Communities and Wetlands Impacts from Bridge Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	Mitigation Measure
VEG-B1: Construction-Related Impacts on Wetland Functioning	See Impacts WQ-F1 and WQ-F2	See Impacts WQ-F1 and WQ-F2	See Impacts WQ-F1 and WQ-F2	See Impacts WQ-F1 and WQ-F2	See Impacts WQ-F1 and WQ-F2	
VEG-B2: Construction-Related Impacts on Vegetation Communities	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
VEG-B3: Change in Extent and Quality of Riparian Habitat	Negligible	Negligible	Minor Beneficial	Moderate Beneficial	Major Beneficial	
VEG-B4: Tree Removal	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
VEG-B5: Changes in Areal Extent and Functions and Values of USACE-Jurisdictional Waters	Negligible	Negligible	Minor Beneficial	Moderate Beneficial	Major Beneficial	
VEG-B6: Change in Habitat for Special-Status Plant Species	Negligible	See Impact VEG-B3	See Impact VEG-B3	See Impact VEG-B3	See Impact VEG-B3	

Impact VEG-B1: Construction-Related Impacts on Wetland Functioning (Short-Term, Year 0)

See Impacts WQ-F1 and WQ-F2.

Impact VEG-B2: Construction-Related Impacts on Vegetation Communities (Short-Term, Year 0)

Impact mechanisms would be similar to those described under Impact VEG-R2, and could arise from construction activities related to bridge and raised roadway construction, as well as the construction of a bypass road.

Bridge Alternative BR0: Negligible. No construction-related impacts would result from leaving the bridge in its current configuration.

Bridge Alternative BR1–BR4: Minor Adverse. The bridge and roadway under all action alternatives would involve disturbance of some mature riparian habitat. Construction could disturb some adjacent riparian habitat, but it would be revegetated with riparian species as soon as possible after disturbance. Impacts are considered minor adverse.

Impact VEG-B3: Change in Extent and Quality of Riparian Habitat (Long-Term, Years 5 and 50)

Existing riparian habitat in the vicinity of upper Pacific Way is relatively mature, dense, and is believed to have a high degree of ecological function, including amenities such as nutrient cycling, shading, and bird habitat. The Bridge Alternatives would remove or replace portions of the existing riparian habitat. While an active revegetation program will be conducted to allow for rapid recovery of the new riparian habitat, habitat functioning of this community (e.g., shading, bird habitat) would be limited in the near term due to its small stature and the absence of snags and dead branches. Over the long term, the new riparian vegetation would become mature and provide replacement ecological function and/or additional function in the case of a net increase in riparian extent. The extent of change in riparian habitat is similar for all alternatives (~0.3 acres), with the exception of Bridge Alternative BR2, which would have a slightly smaller footprint and result in an incremental reduction in the loss of riparian acreage (~0.12 acres).

All Bridge Alternatives would allow for improved channel migration, geomorphic evolution and floodplain function compared to the existing narrow bridge. However, longer bridge spans would allow for relatively greater improvements.

Bridge Alternative BR0: Negligible. No changes in riparian extent or function would result from leaving the bridge in its current configuration.

Bridge Alternative BR1: Negligible. The extent of changes to riparian extent would be similar to that of the other Bridge Alternatives due to similar footprint; however, it would have the narrowest span (50 feet), and so would have the smallest benefits associated with channel migration/geomorphic evolution.

Bridge Alternative BR2: Minor Beneficial. The bridge and roadway would be of reduced footprint compared to Bridge Alternative BR3, resulting in slightly greater acreage of riparian habitat. It would have the same span as Bridge Alternative BR1, and so would have similar benefits associated with channel migration/geomorphic evolution.

Bridge Alternative BR3: Moderate Beneficial. The extent of changes to riparian extent would be similar to that of the other Bridge Alternatives due to similar footprint; however, it would have a wider span than Bridge Alternatives BR1 and BR2, and so would have moderate benefits associated with channel migration/geomorphic evolution.

Bridge Alternative BR4: Major Beneficial. The extent of changes to riparian extent would be similar to that of the other Bridge Alternatives due to similar footprint; however, it would have a widest span of any of the Bridge Alternatives, and so would have the greatest benefits associated with channel migration/geomorphic evolution.

Impact VEG-B4: Tree Removal (Long-Term, Years 0, 5 and 50)

General effects related to removal of riparian trees have been discussed above under Impact VEG-B3. In addition, all action alternatives involve removal of two Monterey pines that are just downstream of the Pacific Way Bridge along Pacific Way to allow for the new roadway. While these trees may provide some habitat value, they do not represent a significant portion of the trees found at the site and are not expected to substantially reduce habitat function.

Bridge Alternative BR0: Negligible. No tree removal would be expected to occur under this alternative.

Bridge Alternatives BR1-BR4: Minor Adverse.

Impact VEG-B5: Changes in Areal Extent and Functions and Values of USACE-Jurisdictional Waters (Long-Term, Years 5 and 50)

Impact VEG-R11 has previously discussed the extent of potential jurisdictional wetlands and other waters of the United States. Potentially jurisdictional waters potentially affected by the Bridge Alternatives are composed entirely of riparian wetland adjacent to Pacific Way.

Differences between the Bridge Alternatives in terms of areal extent are minimal (<0.32 acres), and would be within the overall project maximum of 2.5 acres discussed in Impact VEG-R11 above. The precise amount of both temporary and permanent gain or loss of jurisdictional waters will need to be determined once detailed site plans have been completed, including such factors as pier size, exact dimensions of the roadway approaches, and so on. The new road embankment and new pedestrian path from Hwy 1 will contribute to the loss in areal extent of wetlands.

However, in all cases, losses associated with the bridge are anticipated to be minimal, and are offset by the increase in function and value associated with widening the bridge span from its currently constricted state, which will allow for improved natural geomorphic evolution of the stream channel, improved floodplain function and hydraulic conveyance, and other benefits. This is particularly the case for the wider bridge spans, which would allow for more channel migration and floodplain conveyance/connectivity.

Finally, any losses in areal extent of jurisdictional waters associated with the Bridge Alternatives are overshadowed by the improved ecological functioning, integrity and sustainability of the restoration project as a whole. Because implementing one of the Bridge Alternatives is a necessary component of the overall restoration, considering these factors in combination is appropriate.

Bridge Alternative BR0: Negligible. No actions are anticipated to be taken that would change the areal extent or functions and values of wetlands at the project site.

Bridge Alternative BR1: Negligible. The extent of changes to jurisdictional features would be similar to that of the other Bridge Alternatives due to similar

footprint; however, it would have the narrowest span (50 feet), and so would have the smallest benefits associated with channel migration/geomorphic evolution.

Bridge Alternative BR2: Minor Beneficial. The bridge and roadway would be of reduced footprint compared to Bridge Alternative BR3, resulting in slightly greater acreage of potentially jurisdictional features. It would have the same span as Bridge Alternative BR1, and so would have similar benefits associated with channel migration/geomorphic evolution.

Bridge Alternative BR3: Moderate Beneficial. The extent of changes to jurisdictional features would be similar to that of the other Bridge Alternatives due to similar footprint; however, it would have a wider span that Bridge Alternatives BR1 and BR2, and so would have moderate benefits associated with channel migration/geomorphic evolution.

Bridge Alternative BR4: Major Beneficial. The extent of changes to jurisdictional features would be similar to that of the other Bridge Alternatives due to similar footprint; however, it would have a widest span of any of the Bridge Alternatives, and so would have the greatest benefits associated with channel migration/geomorphic evolution.

Impact VEG-B6: Change in Habitat for Special-Status Plant Species (Long-Term, Years 5 and 50)

As previously described, no special-status plant species are known to occur at the project site. NPS would conduct surveys prior to construction to confirm this and avoid potential effects. California bottlebrush grass could occur in the riparian habitats potentially affected by the Bridge Alternatives. Actions that change the areal extent this habitat could increase the potential for this and other riparian-associated special status species to colonize the project area. In addition, revegetation programs by NPS could result in recolonization of these areas by special-status species.

Bridge Alternative BR0: Negligible. No loss of riparian habitat would result from leaving the bridge in its current configuration.

Bridge Alternatives BR1–BR4: See Impact VEG-B3. Potential effects on riparian-associated special-status plant species would correspond to the extent of riparian habitat lost from each Public Access Alternative. Impact determinations would be as described for Impact VEG-B3.

Fill Disposal Alternatives

Table 4.3.2.1-4 summarizes the potential impacts of Fill Disposal Alternatives on vegetation communities and wetlands at the Unused Reservoir Pit, the Upper Banducci Field and the Coastal Trail. Impacts of fill placement at Hamilton and Dias Ridge are not addressed here because they are or will be addressed in other NEPA documentation. The Fill Disposal Alternatives are described in Chapter 2.

Table 4.3.2.1-4. Potential Vegetation Communities and Wetlands Impacts from Fill Disposal Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail*	Mitigation Measure
VEG-F1: Construction-Related Impacts on Vegetation Communities	Minor Adverse	Negligible	NA	NA	**Moderate Adverse**/Minor Adverse	VEG-MM-1: Conduct Follow-Up Weed Control and Revegetation Activities to Establish Appropriate Native Plant Species
VEG-F2: Increase in Noxious Weed Populations	Minor Adverse	Minor Adverse	NA	NA	**Major Adverse**/Minor Adverse	VEG-MM-1
VEG-F3: Change in Habitat for Special-Status Plant Species	Negligible	Negligible	NA	NA	Minor Adverse	
VEG-F4: Changes in Areal Extent and Functions and Values of Wetlands	Negligible	Negligible	NA	NA	Minor Beneficial	

Note: The analysis of fill placement on vegetation and wetlands is not analyzed for Hamilton or the Dias Ridge Trail.

Impact VEG-F1: Construction-Related Impacts on Vegetation Communities (Short-Term, Year 0)

Some disturbance to existing vegetation at the disposal sites would result from truck delivery of fill material, turn-around areas used by trucks, potential temporary stockpiles, and the placement of fill for long-term storage. Brushy material in areas to be impacted would be cut prior to these activities, and grasses would either be mowed or become matted due to traffic. Vegetation in the long-term storage areas would be scraped prior to fill placement to enhance contact of the fill material with the soil.

Unused Reservoir Pit: Minor Adverse. Some minor trimming of vegetation along the edges of the Coast View trail, the haul route to this fill placement site, would be conducted to facilitate truck passage. The trail-side vegetation is dominated by coyote brush and extensive stands of the invasive nonnative Harding grass. A turn-around area adjacent to the Unused Reservoir Pit, also dominated by coyote brush and nonnative grasses, would be cleared of brush, with roots still in place. This effect would be temporary, and these species would become re-established. While most of the unused pit is sparsely vegetated with

nonnative species, some of its walls are vegetated with native species such as twinberry and blackberry; this vegetation would also be scraped off prior to placement of fill in the reservoir to allow better packing of the fill material. However, due to the generally disturbed condition of the area, these impacts are considered minor.

Upper Banducci Field: Negligible. The vegetation cover that would be scraped prior to fill placement consists primarily of nonnative grasses, particularly wild oats and Harding grass.

Coastal Trail: Moderate Adverse. Stands of both native and nonnative grasses and numerous native grassland forbs occur along the edges of the Coastal Trail. Vegetation would be scraped from the edges of the existing Coastal Trail prior to fill placement for recontouring. The vegetation would be scraped to improve the soil contact of placed fill. The use of fill from this project would reduce the areal extent of trailside areas to be scraped and would therefore slightly reduce the area of vegetation that would be removed for recontouring. Any impact to the existing vegetation, however, is considered a moderate adverse impact due to the relatively high quality of the vegetative composition in this area. Implementation of Mitigation Measure VEG-MM-1 would reduce impacts by establishing appropriate native vegetation communities on the newly placed fill.

Impact VEG-F2: Increase in Noxious Weed Populations (Long-Term, Years 5 and 50)

Placement of disturbed soil generally attracts infestation by fast-growing noxious weed species with widely dispersed propagules. Fill placed in most areas would be a target for new establishment of weedy species. Some fill hauled from the site would also contain propagules of noxious weed species, such as Kikuyu grass, Harding grass, or other species. At the Unused Reservoir Pit or the Upper Banducci Field, any fill potentially containing propagules of weed species would be placed at least a foot under the final grade of the area to avoid growth of the imported propagules. No such material would be used at the Coastal Trail; only substrate composed of weed-free rocky-clayey material would be hauled to the Coastal Trail.

Unused Reservoir Pit: Minor Adverse. The newly placed fill would be topped with several inches of silty material that could facilitate establishment of native species, but the extensive stands of Harding grass around the Unused Reservoir Pit and along the Coast View Trail would easily extend onto the fill placement site. Prevention of this establishment would require a more extensive control of Harding grass along the Coast View trail than is within the scope of this project. The new establishment of nonnative species on this fill site, however, would not represent a new threat to native habitats. Since the existing Unused Reservoir Pit currently supports little vegetation, the filling, recontouring and planting of native species at the site represents a minor beneficial impact, but the overall impact is minor adverse since nonnative weedy species would still dominate in the long run.

Upper Banducci Field: Minor Adverse. Harding grass as well as other nonnative species, such as French broom, pampas grass, and other species that occur in the vicinity would be likely to become established on the newly placed fill. Wild oats would not be as likely to become established as the more noxious nonnative species.

Coastal Trail: Major Adverse. Fill placement in newly recontoured portions of the Coastal Trail would become a magnet for noxious vegetation in areas that otherwise have healthy cover by native grasses and forbs. Nonnative thistles, pampas grass, and poison hemlock as well as nonnative noxious grasses, such as Harding grass, are likely to become established on the fill in areas where such species may not already occur. Their proximity to relatively healthy coastal grasslands would represent a new threat to the native habitats. Implementation of Mitigation Measure VEG-MM-1 would reduce impacts.

Impact VEG-F3: Change in Habitat for Special-Status Plant Species (Long-Term, Years 5 and 50)

Based on rare plant surveys conducted by NPS, no special-status plant species are known to occur in the vicinity of the Unused Reservoir Pit or the Upper Banducci Field. However, as previously discussed, two special status species, the San Francisco wallflower and California bottlebrush, occur on the coastal hills south of Muir Beach, where the Coastal Trail occurs. Based on their currently observed locations, they do not occur in areas where recontouring is likely to be conducted.

Unused Reservoir Pit and Upper Banducci Field: Negligible. No rare plant populations are expected to be affected by placement of fill in these areas.

Coastal Trail: Minor Adverse. The known populations of the two special status species in this area do not occur adjacent to the coastal trail where fill is likely to be placed for trail recontouring. However, NPS would conduct rare plant surveys at the appropriate time of year to confirm this and avoid fill placement on these species. Even by planning to avoid the impacts, there is a potential minor adverse impact due to the possibility that a population could be overlooked or inadvertently impacted.

Impact VEG-F4: Changes in Areal Extent and Functions and Values of Wetlands (Long-Term, Years 0, 5 and 50)

Neither the Unused Reservoir Pit nor the Upper Banducci Field has USACE-jurisdictional wetlands or wetlands as mapped under the more conservative Cowardin system. There is the potential that some seeps, springs or ephemeral drainages along portions of the Coastal Trail could be either USACE jurisdictional wetlands or wetlands as mapped under the Cowardin system, but a determination has not been made.

Unused Reservoir Pit: Negligible. No impact to wetlands is expected due to fill placement in this location.

Upper Banducci Field: Minor Adverse. While the upper field does not have jurisdictional wetlands, the haul route to the field includes a drainage crossing that is jurisdictional. The drainage is an intermittent tributary to Redwood Creek, which is dry during summer months. It is adjacent to the gravel driveway on the Banducci Site. To avoid driving trucks on a filled portion of the driveway that is susceptible to damage from the weight of heavy trucks, trucks with fill would cross the drainage and travel across the field to the upper field. The drainage crossing would be temporarily filled to allow safe passage by the trucks. Fill would be removed prior to the onset of fall rains, and original contours would be re-established. The haul route through the lower end of the field is not a jurisdictional wetland.

Coastal Trail: Minor Beneficial. Prior to fill placement and possible recontouring of portions of this trail, NPS would conduct a field survey of the Coastal Trail for wetlands that are either USACE jurisdictional or wetlands as defined by the Cowardin mapping system. If it appears likely that an USACE jurisdictional wetland occurs where fill would be placed, a wetland delineation would be conducted and appropriate permitting procedures would be followed with the USACE. One purpose of the possible trail recontouring would be to improve natural contours and natural drainage patterns so that the impacts of trails on natural resources are reduced. For instance, in the pre-existing condition of a typical hillside trail slated for recontouring, water from a broad area of hillside is routed to a narrow flow path that not only contributes to erosion and gullies, but also diverts flows from adjacent habitat that would be supported by it. During layout of a trail realignment on park property, particular attention is given to wet areas, whether or not they are jurisdictional wetlands, to reduce trail impacts and expand the area available for natural drainage patterns. Generally, placement of fill in wet areas is either avoided or would be conducted in a manner that would improve natural drainage patterns. It is likely that fill placement on the Coastal Trail as part of a recontouring project would be overall beneficial to possible wetlands functions and values as well as other native habitats, even if some small jurisdictional areas were to be filled. Possible impacts to wetlands in these areas are considered self-mitigating.

Mitigation Measures

Mitigation Measure VEG-MM-1: Conduct Follow-Up Weed Control and Revegetation Activities to Establish Appropriate Native Plant Species.

Prior to placing fill in any of the proposed locations, NPS will prepare a weed control and revegetation plan appropriate for the particular fill site to avoid establishing new populations of weeds that threaten native habitats. The plan will identify specific target species for control and methods of control. The plan will also identify appropriate native species to be revegetated onto the fill site and propagules to be used, such as either nursery-grown plant stock or native seed.

Exhibit 2: Final Environmental Impact Statement

4.3.2.2 Wildlife and Wildlife Habitat

Guiding Regulations and Policy

The NPS Organic Act (16 USC l, 2, 3, and 4), which directs parks to conserve wildlife unimpaired for future generations, is interpreted by NPS to mean that all native animal life should be protected and perpetuated as part of the park's natural ecosystem. Wildlife, for the purposes of this section, includes all native animals including mammals, birds, amphibians, and reptiles, as well as invertebrate species. Fish species are also considered wildlife but are discussed in Section 4.3.2.3, *Fisheries*. Natural processes are relied on to support populations of native species to the greatest extent possible; also, native species are protected from harvest, harassment, or harm from human activities. According to NPS Management Policies (2006a): "National Park Service will maintain as parts of the natural ecosystems of parks all plants and animals native to park ecosystems."

Management goals for wildlife include maintaining components of naturally evolving park ecosystems, which includes the following objectives.

- Maintain the natural abundance, diversity, and ecological integrity of plants and animals.
- Prevent the introduction of exotic (non-native) plant and animal species into units of the national park system.

NPS Management Policies (National Park Service 2006a) provide a high level of protection for animal species listed as threatened or endangered by the Federal Endangered Species Act. Additionally, NPS Management Policies require park managers to ensure that NPS operations do not adversely affect endangered, threatened, candidate, or sensitive species and their critical habitats, within or outside NPS property, and park managers must consider federal- and state-listed species and other special-status species in all plans and NEPA documents (National Park Service 1991).

The ESA and CESA define the plant and animal species that must be especially protected because of their imperiled status. These mandates list the protected animals as threatened or endangered, and protect habitat necessary to their continuance. The ESAs are administered by the following agencies.

- USFWS (ESA, terrestrial and freshwater species),
- NMFS (ESA, marine and anadromous fishes), and
- DFG (CESA).

The following definitions apply to the ESA and CESA categories for special-status species.

- Federal endangered: Any species that is in danger of extinction throughout all or a significant portion of its national range.
- Federal threatened: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its national range.
- California endangered: Any species that is in danger of extinction throughout all or a significant portion of its range in the state.
- California threatened: Any species that is likely to become an endangered species with the foreseeable future throughout all or a significant portion of its state range.

Furthermore, the ESA may specify *critical habitat*—habitat necessary for the survival of a listed species, subspecies, or population—and may limit human activities in these designated areas.

The ESA requires federal agencies to consult with USFWS before taking actions that (1) could jeopardize the continued existence of any federally listed plant or animal species (e.g., listed as threatened or endangered) or species proposed for listing, or (2) could result in the destruction or adverse modification of critical or proposed critical habitat.

Under NEPA, NPS is required to consider whether an action may violate federal, state, or local laws or requirements imposed for the protection of the environment. For this reason, species listed under CESA (i.e., those considered endangered or threatened) by DFG are included in this analysis. Species proposed for listing in either of the two categories are also included.

CEQA mandates the avoidance, minimization, and mitigation of adverse impacts to sensitive habitats and wildlife species identified by DFG or USFWS. *Special-status species* for the purposes of this section are animals that are legally protected under state or federal laws or other regulations, as well as species considered sufficiently rare by the scientific community to qualify for such listing. Special-status species include the following categories of animals.

- Animals listed or proposed for listing as threatened or endangered under the ESA or CESA.
- Animals that are candidates for possible future listing as threatened or endangered under the ESA or CESA.
- Animals designated as species of special concern by the California Department of Fish and Game.
- Animals fully protected under the California Fish and Game Code.

Study Area

The study area for wildlife and wildlife habitat is the entire project area, as described in Chapter 2 and shown in Figure 2-1.

Analysis Thresholds

General

The following thresholds, which are based on NPS management objectives, were used to determine the magnitude of effects to wildlife and wildlife habitat.

- **Negligible:** Alternative would result in no observable or measurable impacts on native species, their habitat, or the natural processes sustaining them. Impacts would be of short duration and well within natural fluctuations.
- **Minor:** Alternative would result in measurable or perceptible changes, which would be localized within a relatively small area: however, the overall viability of wildlife populations or their habitat would not be affected. Without further impacts, minor adverse effects would be reversed, and the resource would recover.
- **Moderate:** Alternative would be sufficient to cause a change in the wildlife populations or their habitat (i.e., abundance or distribution of the species; quantity or quality of habitat); however, the impact would remain localized. The change would be measurable, but negative effects could be reversed in the long term.
- **Major:** Alternative would result in changes that are substantial, highly noticeable, measurable, and could be irreversible (permanent). Wildlife populations and/or habitat would be unlikely to recover.

California Red-Legged Frog

While the above thresholds were used in general to determine impacts to wildlife species, the following additional thresholds were used to evaluate impacts on CRLF more specifically.

- **Negligible:** Alternative would result in imperceptible or immeasurable change.
- **Minor:** Alternative would result in localized impacts, short-term (a few days to a few weeks) changes in behavior, and/or displacement from foraging habitats due to disturbance. Impacts are expected to continue for less that 1 year.
- **Moderate:** Alternative would result in a local population decline due to direct mortality, reduced survivorship, declines in population, and/or a shift in distribution. The decline would involve a small portion of the total population and could increase the length of time projected for full recovery and removal from the endangered species list. Because it is difficult to quantify the loss of frogs, this effect would be measured in temporary loss of aquatic habitat. Impacts are expected to continue for 1 to 5 years.

- **Major:** Alternative would result in one or more of the following conditions:
  - A population decline in the project area due to direct mortality, reduced survivorship, declines in reproduction, and/or a shift in distribution. The decline would be at a level that the continued existence of the population within the study area would be at risk.
  - Substantial disruption of the habitat, including upland, foraging, and breeding habitat for CRLF.
  - Permanent interference with the seasonal movements of CRLF within the park or surrounding areas.
  - Removal of CRLF individuals from the population.
  - The integrity of both breeding and upland habitat for CRLF would be jeopardized.

Methods and Assumptions

Restoration activities could adversely affect wildlife species through direct disturbance of plants, animals, and their habitats, as well as long-term changes in available habitat. Even management actions designed to benefit habitat, such as restoration, can have inadvertent adverse effects on special-status species. For example, the project may result in changes in the areal extent of vegetation communities that provide habitat for special-status species.

The following methods and assumptions were used to evaluate how alternatives would affect wildlife.

- The following previous NPS work and mapping were reviewed to determine habitat data.
  - Feasibility analysis report (Philip Williams & Associates et al. 2004).
  - CRLF surveys of lower Redwood Creek, GGNRA (Fellers and Guscio, 2004; Wood, 2004; Fellers and Kleeman, 2005; Wood, 2006~~National Park Service 2004, 2006~~).
  - 1994 environmental assessment (Philip Williams & Associates et al. 1994).
  - 2003 site analysis report (Philip Williams & Associates 2003).
- Park staff, through their best professional judgment, provided information on special-status species in the study area.
  - Darren Fong (pers. comm.) provided information about the project and impact mechanisms, including habitat loss, off-site mitigation locations, construction mitigation measures, and predator issues.
  - Carolyn Shoulders (pers. comm. [a]) provided a project overview and discussion of potential special-status species issues.

- The following databases were consulted to identify special-status species that could potentially occur in the project area.
  - The CNDDB (California Natural Diversity Database 2006) records for the Point Bonita USGS 7.5-minute quadrangle and the following five surrounding quadrangles: San Quentin, San Francisco North, San Francisco South, San Rafael, and Bolinas.
  - USFWS' special-status species list for the above USGS quadrangles (2006).
- A pre-field review was conducted of other available literature and resources.
  - USFWS Recovery Plan for CRLF (U.S. Fish and Wildlife Service 2002).
  - Draft Summary Notes Technical Scoping on Wetland, Vegetation, and Marine Mammals for Big Lagoon Wetland and Creek Restoration (August 24, 2002) (National Park Service 2002).
  - Big Lagoon Wetland and Creek Restoration NPS Extended Team (October 9, 2003 Meeting Notes) (National Park Service 2003).
  - Input regarding CRLF at Big Lagoon at a March 3, 2004 Meeting with USFWS (National Park Service 2004).
  - Big Lagoon wetland and creek restoration public workshops (September 30 and October 4 2003 draft transcription of Meeting Notes) wildlife concerns and issues for the Final EIS/EIR (National Park Service 2003).
  - Discussion points for preliminary analyses Big Lagoon wetland and creek restoration Final EIS/EIR kick-off meeting (January 13, 2005).
- Field reconnaissance was conducted by Jones & Stokes biologists Stephanie Myers (CRLF and other wildlife species) and John Sterling (birds) on January 16, 2005 of the location of the proposed alternatives including parking lots.

Information from all of the above-mentioned sources, including the field survey, was used to identify sensitive natural communities, native wildlife species, and areas of suitable habitat in the study area and vicinity.

The following parameters were used to evaluate the consequences of the various alternatives on special-status wildlife species.

- The species affected and its degree of local, regional, national, and global rarity.
- The rarity of the genotype or subspecies, regionally, nationally, or globally.
- The number of individuals or proportion of the species range affected by the alternative.
- The response of the species to restoration or disturbance, on a population or subpopulation level.

California Red-Legged Frog

In addition to the above methodology, the following steps were taken in assessing impacts on CRLF.

- Areas of CRLF habitat likely to be affected were quantified based on acreage of available habitat. Since the population is so small and data are limited, acreage of available habitat was determined to be the most accurate proxy for impacts on the existing population.
- Extent of habitat likely to be lost (including breeding and non-breeding habitat) or altered was determined based on total acreage estimates. These estimates were based on the restorative potential of an area under ideal conditions. The habitats planned to be restored were assumed to reestablish commensurate with habitats of the same type in the study area. (For example: if there was a freshwater marsh on site that only provides marginal habitat for a species, it was assumed that a newly built marsh would provide habitat in a similar fashion)
- Displacement and disturbance potential of the actions and the species' potential to be affected by the activities was assessed based on best professional judgment. It was assumed that species that would be displaced would colonize newly constructed suitable habitat on the project site.
- Potential for sustained, viable CRLF habitat to be available under each alternative was quantified based on the planned acreage emergent wetland habitats. It was assumed that CRLF would readily colonize newly constructed sites and breed successfully.
- Construction-related impacts were quantified based on best professional judgment and impacts to species were determined based on the timing and nature of construction activities. (For example: if a construction activity involved removing vegetation, it was assumed that any species that would use that vegetation during any part of its life cycle could be impacted by the construction activity.
- Effects of several hydrological regimes including no water on the habitat quality were evaluated.
- Habitat quality (e.g., water duration, water depth, salinity, velocity) was assessed.
- The alternatives were evaluated against the USFWS recovery plan for CRLF for consistency
- Potential for beneficial changes to CRLF habitat and populations was assessed.

Restoration Alternatives

This table summarizes the potential impacts of Restoration Alternatives to wildlife in the study area. The Restoration Alternatives are described in Chapter 2.

Table 4.3.2.2-1. Potential Wildlife Impacts from Restoration Alternatives

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
WLD-R1: Effects of the Short-Term Loss of Mature Riparian Habitat on Riparian-Associated and Cavity-Nesting Avian Species	Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	WLD-MM-1: Preconstruction Surveys and Possible Installation of Nest Boxes
WLD-R2: Long-Term Effects of Riparian Enhancement on Riparian-Associated and Cavity-Nesting Species	Negligible	Moderate Beneficial	Minor Beneficial	Minor Beneficial	
WLD-R3: Construction-Related Disturbance to Nesting Birds	Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	WLD-MM-2: Conduct Preconstruction Bird Surveys
WLD-R4: Operations And Maintenance Disturbance to Nesting Birds	Negligible	Negligible	Negligible	Negligible	
WLD-R5: Removal and/or Degradation of Emergent Wetland Habitat Used as Breeding, Foraging, and Roosting Habitat by Marsh Birds	Negligible	Moderate Adverse	Moderate Adverse (Year 5); Minor Adverse (Year 50)	Moderate Adverse	
WLD-R6: Effects on Waterfowl from Changes in Open Water Habitat	Negligible	Minor Beneficial	Minor Beneficial	Moderate Beneficial	
WLD-R7: Construction-Related Mortality of CRLF	Negligible	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	WLD-MM-3: Limit Construction Access Routes and Equipment Staging Areas and Conduct Preconstruction Surveys for CRLF in All Suitable Habitat That Will Be Disturbed by Construction
WLD-R8: Changes in Extent of CRLF Habitat	Minor Adverse/ Minor Adverse	Minor Beneficial	Minor Beneficial/ Minor Beneficial	Minor Beneficial/ Minor Beneficial	WLD-MM-4: Augment CRLF Breeding Habitat WLD-MM-5: Implement Monitoring and Contingency Measures for CRLF WLD-MM-6: Reintroduce CRLF to Supplement Existing Population On Site
WLD-R9: Operations and Maintenance Effects on CRLF	Negligible	Negligible	Negligible	Negligible	

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
WLD-R10: Temporary Loss of CRLF Breeding Habitat During Construction	Negligible	Negligible	Negligible	Negligible	
WLD-R11: CRLF Habitat Fragmentation	Negligible	Moderate Beneficial	Minor Beneficial	Minor Beneficial	
WLD-R12: Increased Salinity Levels and Effects on CRLF	Negligible	Negligible	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	WLD-MM-7: Implement Measures to Protect CRLF from Temporary Saltwater Intrusion.
WLD-R13: Increased Predation on CRLF from Fish	Negligible	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Major Adverse**/ Moderate Adverse	All Alternatives: WLD-MM-5 Alternatives 3 and 4: WLD-MM-4: Augment CRLF Breeding Habitat
WLD-R14: Overall Effects on CRLF	**Moderate Adverse**/ Minor Adverse	Negligible	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	See above
WLD-R15: Effects on Special-Status Bird Species	Negligible	See Impacts WLD-R1 through WLD-R6	See Impacts WLD-R1 through WLD-R6	See Impacts WLD-R1 through WLD-R6	WLD-MM-1 WLD-MM-2
WLD-R16: Effects on Known Northern Spotted Owl Breeding Territories	Negligible	Negligible	Negligible	Negligible	
WLD-R17: Effects of Restoration on Transitional Monarch Butterfly Populations	Negligible	Negligible	Negligible	Negligible	
WLD-R18: Effects on Other Common Species of Wildlife	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
WLD-R19: Effects on Bats	Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	WLD-MM-8: Implement Measures to Protect Bat Populations

Impact WLD-R1: Effects of the Short-Term Loss of Mature Riparian Habitat on Riparian-Associated and Cavity-Nesting Avian Species (Short-Term, Year 5)

The relocation of Redwood Creek under all action alternatives, and other construction activities associated with the restoration effort, will result in a temporal loss of riparian habitat along this corridor between the time when restoration takes place and new riparian vegetation is established. Because of the

active revegetation program, establishment of a new riparian corridor will begin almost immediately following the completion of creek relocation, but the benefits of mature riparian vegetation (i.e., established vegetative structure, older trees with cavities) will not be realized in the short-term.

Restoration Alternative 1: Negligible. Under this alternative, no actions would be taken that would result in a change in the extent of mature riparian habitat in the project area. However, due to reduced groundwater levels, the Green Gulch pasture area may begin to develop riparian characteristics.

Restoration Alternative 2, 3, 4: Minor Adverse. Removal of limited areas of riparian habitat for restoration construction would be a short-term impact. Short-term loss of riparian habitat would be supplanted by introduction of new riparian habitat, which would not have the same value as mature riparian habitat during the short-term. The total loss of mature riparian habitat is 3, 2.6, and 5.8 acres for Alternatives 2, 3, and 4, respectively, and none of these are substantial when compared to the amount of this habitat type upstream along Redwood Creek. Mitigation measure WLD-MM-1, which involves installation of nesting boxes, would reduce this impact on cavity-nesting species.

Impact WLD-R2: Long-Term Effects Of Riparian Enhancement on Riparian-Associated and Cavity-Nesting Species (Long-Term, Year 50)

Though a loss of mature riparian habitat is an unavoidable consequence of project implementation during the short term, over the long term riparian acreage will increase in the study area under all action alternatives. This will benefit riparian-associated bird species, and will result in the recruitment of additional snags and associated cavities for cavity-nesting species. In addition, removal of the levee road under all alternatives will reduce fragmentation of riparian habitat.

Restoration Alternative 1: Negligible. Under this alternative, no actions would be taken that would result in a change in the extent of mature riparian habitat in the project area. However, due to reduced groundwater levels, the Green Gulch pasture area may begin to develop riparian characteristics.

Restoration Alternative 2: Moderate Beneficial. Enhancement of riparian habitat would be beneficial in the long term because the extent of riparian habitat would eventually increase to 21.4 acres, an increase of 8.2 acres over existing conditions. In addition, the length and width of contiguous riparian corridors are expected to be greatest under this alternative, which increases riparian value to breeding and migratory birds, as well as resulting in additional snags for cavity nesters, and is considered beneficial.

Restoration Alternative 3: Minor Beneficial. Enhancement of riparian habitat would be beneficial in the long term because the extent of riparian habitat would eventually increase to 16.1 acres, an increase of 2.9 acres over existing conditions. The width of contiguous functioning riparian corridors would tend to increase over time as the open water areas fill in and are converted to wetland habitat.

Restoration Alternative 4: Minor Beneficial. Enhancement of riparian habitat would be beneficial in the long term because the extent of mature riparian habitat would eventually increase to 14.7 acres, an increase of 1.5 acres over existing conditions. The width of contiguous functioning riparian corridors would be reduced in the lower reaches because of the presence of the lagoon, but the general function of the riparian corridor would be enhanced relative to existing conditions.

Impact WLD-R3: Construction-Related Disturbance to Nesting Birds (Short-Term, Year 0)

Restoration activities would involve the removal of vegetation in the form of trees, shrubs, and grasslands, especially during the initial clearing and grubbing stages. This vegetation in all habitat types provides suitable nesting habitat for several species of migratory birds. Vegetation removal associated with interim flood reduction measures would be minimal.

Restoration Alternative 1: Negligible. Periodic maintenance dredging is not likely to disturb nesting birds because the NPS does not allow any vegetation removal associated with maintenance activities to occur between January 1–July 31 (trees) and March 1–July 31 (shrubs and grasses more than 8 inches tall). Any impacts realized due to emergency vegetation cutting will be mitigated through the Project Review process outlined in the GGNRA vegetation cutting and removal standard operating procedures (Golden Gate National Recreation Area 1995).

Restoration Alternatives 2, 3, 4: Minor Adverse. Though impacts to nesting birds will be minimized due to the proactive operating procedures by NPS (as discussed under Restoration Alternative 1), the potential still exists to disturb nesting birds due to unforeseen circumstances during restoration. mitigation measure WLD-MM-2, performing preconstruction bird surveys, would reduce this impact.

Impact WLD-R4: Operations And Maintenance Disturbance to Nesting Birds (Long-Term, Years 5 and 50)

General maintenance activities will be required as a result of the restoration activities. These activities will be similar in nature to the activities that are currently ongoing at the site.

Restoration Alternatives 1, 2, 3, 4: Negligible. In accordance to the GGNRA Standard Operating Procedures for vegetation cutting and removal, operations and maintenance activities with the potential to disturb nesting birds are conducted outside of nesting season.

Impact WLD-R5: Removal and/or Degradation of Emergent Wetland Habitat Used as Breeding, Foraging, and Roosting Habitat by Marsh Birds (Long-Term, Years 5 and 50)

Under each of the action alternatives emergent wetland habitat on the site will be reduced from the existing condition. This will result in the loss of breeding and foraging habitat for several species of marsh birds.

Restoration Alternative 1: Negligible. Under this alternative, no actions would be taken that would change the extent of emergent wetland habitat at the site.

Restoration Alternative 2: Moderate Adverse. Under this alternative, there would be a maximum potential loss of emergent wetland habitat at both Year 5 (up to 11.5 acres) and Year 50 (12.1 acres), although the long-term mosaic of vegetation types is difficult to predict because cattails would die off slowly with groundwater lowering, but would will still be inundated seasonally, and long-term sea level rise could lead to a return of existing groundwater elevations. The construction of two emergent wetlands, one at the confluence of Redwood Creek and the Green Gulch Tributary, and a second in the upper pasture, will partially compensate for the loss of emergent wetlands through the restoration process. Existing cattail habitat may persist for at least 5 years even under altered groundwater elevations. Though the constructed ponds will be smaller in size than current conditions, the fact that they will be managed for wetland vegetation and have a reliable source of groundwater ensures higher quality breeding habitat over the long term. This is considered a moderate but less-than-significant impact.

Restoration Alternative 3: Moderate Adverse (Year 5), Minor Adverse (Year 50). Under this alternative, there would be a loss of emergent wetland habitat at both Year 5 (10.2 acres) and Year 50 (6.7 acres). The construction of new emergent wetlands adjacent to the lagoons will partially compensate for the loss of emergent wetlands through the restoration process. Though these areas will be smaller in size than current conditions, the fact that they will be managed for wetland vegetation and have a reliable source of groundwater ensures higher quality breeding habitat. In addition, the lagoons would fill in over time, creating some recovery in the extent of wetland habitat over the long term. This is considered a moderate but less-than-significant impact at Year 5, reducing to a minor impact by Year 50.

Restoration Alternative 4: Moderate Adverse. Under this alternative, there would be a loss of emergent wetland habitat at both Year 5 (10.2 acres) and Year 50 (9.8 acres). The construction of new emergent wetlands adjacent to the lagoon will partially compensate for the loss of emergent wetlands through the restoration process. Though these areas will be smaller in size than current conditions, the fact that they will be managed for wetland vegetation and have a reliable source of groundwater ensures higher quality breeding habitat over the long term. This is considered a moderate but less-than-significant impact.

Impact WLD-R6: Effects on Waterfowl from Changes in Open Water Habitat (Long-Term, Years 5 and 50)

All action alternatives result in a net increase in open water habitat. This provides greater foraging opportunities for both dabbling and diving ducks as well as several other species of waterfowl that utilize the area during different times of the year. For waterfowl species that breed on the site, all three action alternatives will increase the amount of shoreline habitat used for nesting habitat for these species.

Restoration Alternative 1: Negligible. No actions would be taken that would change the extent of open water habitat.

Restoration Alternative 2: Minor Beneficial. Under this alternative, there would be an increase of open water habitat by Year 5 (1.4 acres), reducing to a minor increase by Year 50 (0.3 acres).

Restoration Alternative 3: Minor Beneficial. Under this alternative, there would be an increase of open water habitat by Year 5 (4.3 acres), reducing to a minor increase by Year 50 (0.2 acres).

Restoration Alternative 4: Moderate Beneficial. Under this alternative, there would be an increase of open water habitat at Year 5 (9.2 acres). This effect would persist through Year 50 (4.6 acres), although the increase would be somewhat muted because of transition to wetlands and other habitat. However, this alternative would increase habitat for open water bird species throughout the lifetime of the project.

Impact WLD-R7: Construction-Related Mortality of CRLF (Short-Term, Year 0)

Construction activities associated with the Restoration Alternatives could result in the take of individual CRLFs. This can occur in many ways, but the most likely mechanism is through frogs being crushed by construction equipment in aquatic habitats, or being excavated from burrows or other refugia in upland habitats during ground disturbing activities. Under Restoration Alternative 2, potential would be minimized by avoiding existing aquatic habitat that is known to be used by CRLF. Under all alternatives, pre-construction surveys and relocation of CRLF where necessary would minimize the potential for construction impacts. Excavation in existing aquatic habitat may also only occur when egg masses and tadpoles are not expected (August 1~~15~~–October 31) for further protection of frogs.

Restoration Alternative 1: Negligible. Periodic maintenance dredging conducted near the Pacific Way Bridge is not likely to significantly affect CRLF.

Restoration Alternative 2: Moderate Adverse. Interim dredging activities conducted near the Pacific Way Bridge are not likely to significantly affect CRLF.

Under the restoration action, a large portion of the site would be subject to ground-disturbing activities that could result in CRLF mortality. The most likely impacts would be in upland habitats during ground-disturbing activities, since existing aquatic habitat would be avoided (Restoration Alternative 2). This is considered a moderate adverse, significant impact. Implementation of mitigation measure WLD-MM-3, which would limit construction access routes and equipment staging areas and require preconstruction surveys for CRLF in all suitable habitat that will be disturbed by construction, would reduce this impact to a less-than-significant level.

Restoration Alternatives 3 and 4: Moderate Adverse. Interim dredging activities conducted near the Pacific Way Bridge are not likely to significantly affect CRLF.

Under the restoration actions, a large portion of the site would be subject to ground-disturbing activities that could result in CRLF mortality. The most likely impacts would be in upland habitats during ground disturbing activities, since frogs would be relocated to new aquatic habitat prior to the onset of construction activities, and no construction would take place in existing aquatic habitat during the breeding season. This is considered a moderate adverse, significant impact. Implementation of mitigation measure WLD-MM-3, which would limit construction access routes and equipment staging areas and require preconstruction surveys for CRLF in all suitable habitat that will be disturbed by construction, would reduce this impact to a less-than-significant level.

Impact WLD-R8: Changes in Extent of CRLF Habitat (Long-Term, Year 5 and 50)

A decrease in emergent wetland habitat on the site would reduce the amount of available CRLF breeding, foraging, and over summering habitat. Interim flood reductions conducted near the Pacific Way Bridge would not impact groundwater elevations or ponded water for the CRLF and would therefore not impact the extent of CRLF habitat. Following the restoration, groundwater levels would be somewhat lower than existing conditions and similar to those of the early 1990s; however, new wetland features would be designed to take this into account and are anticipated to have the necessary groundwater inflows to support CRLF habitat through the dry season. Note that aquatic habitat known to be used by CRLF would not be disturbed under Restoration Alternative 2; much of the other aquatic habitat on the site, while potentially suitable, has not been known to be used by CRLF.

Restoration Alternative 1: Minor Adverse. Recent efforts by NPS to improve drainage for flood reduction in the area have lowered surface water and groundwater in the Green Gulch pasture, degrading breeding habitat for CRLF and threatening their persistence at the site. Future maintenance activities could have similar effects.

NPS would continue to implement measures to encourage ponding and growth of emergent vegetation (e.g., cattails) to improve site conditions for breeding and rearing CRLF, such as operation of the existing flashboard weir. However, this remains a minor significant impact. Mitigation measures WLD-MM-5 and 6, which involve implementation of monitoring and contingency measures for CRLF, would ensure that this impact would be less than significant.

Restoration Alternative 2: Minor Beneficial. Existing emergent wetland breeding habitat used by CRLF would be avoided as part of project design. In addition, it would be augmented by two new emergent wetlands, one at the confluence of the two Green Gulch tributaries and the other in the upper pasture. Overall habitat extent, function and quality would be improved. The final grading design would ensure that new habitat is designed to provide the necessary

hydroperiod, vegetation, and microhabitat features for breeding and rearing frogs. Overall, these systems would be more stable and sustainable than the existing wetlands, which are maintained through ongoing management intervention (i.e., the flashboard weir). Removal of existing power lines near CRLF habitat will also reduce potential bird predation.

Over time, the changes in groundwater levels, if they remain at elevations occurring just after construction, would cause the existing CRLF habitat to trend towards riparian vegetation. However, sea level rise provided for the IPCC and used in analyses for this Final EIS/EIR could lead to a return to groundwater levels similar to those occurring today, maintaining large stands of emergent vegetation. There is some uncertainty as to whether CRLF would colonize the new habitat, because existing suitable habitat at and near the site is not occupied. For this reason, this otherwise moderate beneficial impact is considered a minor beneficial impact. While this impact does not require mitigation, mitigation measure WLD-MM-4, which involves construction of additional CRLF habitat at the Banducci site, and mitigation measure WLD-MM-5 and WLD-MM-6 (monitoring and contingency measures) have been included as contingencies should CRLF not ultimately colonize the new wetlands.

Restoration Alternative 3: Minor Beneficial. While there would be an overall loss of emergent wetland habitat at the site under this alternative, including the emergent wetland (approximately 1 acre) currently occupied by CRLF (Fellers and Guscio 2004), replacement with new suitable habitat (approximately 2.7 acres at Year 5) would represent an increase in extent. By Year 50, increased sedimentation would result in the loss of some of this habitat. Overall, the restored habitat would generally provide the necessary hydroperiod, vegetation, and microhabitat features for breeding and rearing frogs. The final grading design would ensure that new habitat is designed to provide the necessary hydroperiod, vegetation, and microhabitat features for breeding and rearing frogs. These systems would be more stable and sustainable than the existing wetlands, which are maintained through ongoing management intervention (i.e., the flashboard weir). However, there is no assurance that CRLF would use this replacement habitat because existing suitable habitat at and near the site is not occupied. For this reason, this otherwise moderate beneficial impact is considered a minor beneficial impact. Mitigation measure WLD-MM-4, which involves construction of additional CRLF habitat at the Banducci site, and mitigation measure WLD-MM-5 and WLD-MM-6 would help ensure benefits.

Restoration Alternative 4: Minor Beneficial. Impacts would be similar to Restoration Alternative 3, although the additional amount of suitable habitat would be greater (approximately 4 acres at Year 5). Overall this alternative is anticipated to have beneficial effects, which would be ensured by implementation of mitigation measure WLD-MM-4, WLD-MM-5, WLD-MM-6, and WLD-MM-7.

Impact WLD-R9: Operations and Maintenance Effects on CRLF (Long-Term, Years 5 and 50)

CRLF adults, tadpoles, and eggs could be affected by ongoing maintenance activities, including invasive species removal, maintenance of plantings, and mosquito abatement.

Restoration Alternatives 1, 2, 3, 4: Negligible. Impacts are anticipated to be similar across all alternatives. NPS does not allow work in breeding areas during breeding season. Any use of equipment in CRLF habitat requires surveys in advance to locate frogs; work is halted if frogs are located. In addition, under each of the action alternatives less maintenance will be required in CRLF breeding areas because emergent wetlands will be groundwater fed.

Impact WLD-R10: Temporary Loss of CRLF Breeding Habitat During Construction (Short-Term, Year 0)

This impact accounts for the temporary loss of CRLF habitat during construction. Because areas currently being used by CRLF will be altered during the actions of Restoration Alternatives 3 and 4, existing CRLF breeding habitat will be lost even though additional suitable breeding habitat will be constructed. Note that in the case of Restoration Alternative 2, existing breeding habitat would not be disturbed. For impacts of construction on individual frogs, refer to Impact WLD-R7.

Restoration Alternative 1: Negligible. Periodic dredging would not take place in emergent wetland habitat used by CRLF, and NPS does not allow activities in breeding habitat during the CRLF breeding season without a survey.

Restoration Alternative 2: Negligible. Under this alternative, existing habitat would be preserved. As such, there would be no temporal loss of habitat.

Restoration Alternative 3 and 4: Negligible. Under these alternatives, new suitable habitat for CRLF would be constructed prior to the restoration action. Before beginning work in existing habitat, CRLF egg masses and tadpoles would be relocated, and the new habitat would be monitored to verify that it has suitable habitat characteristics and is occupied by CRLF. As such, there would be no temporal loss of habitat.

Impact WLD-R11: CRLF Habitat Fragmentation (Long-Term, Years 5 and 50)

Under current conditions the small breeding population of CRLF on the site is isolated from other, larger populations outside of the Redwood Creek watershed.

Restoration Alternative 1: Negligible. Under continued conditions, CRLF would remain isolated and unconnected to suitable dispersal and breeding habitat. Individuals are only likely to emigrate from the site in search of other breeding populations if the breeding population at Big Lagoon exceeds current carrying capacity. Because this represents a continuation of current conditions, this impact is considered negligible.

Restoration Alternative 2: Moderate Beneficial. The alternative would provide better CRLF breeding habitat and more of it. In addition, if the additional habitat that would be constructed is colonized and a larger and more stable breeding CRLF population establishes at the site, individuals will begin to emigrate from the site in search of other breeding populations. This is only likely to occur when the breeding population at Big Lagoon reaches its carrying capacity. Mitigation measure WLD-MM-4 (augmentation of breeding habitat at the Banducci site) would provide some suitable off-site habitat to which CRLF could emigrate.

Restoration Alternatives 3 and 4: Minor Beneficial. Impacts would be similar to Restoration Alternative 2. However, they would also remove the only known breeding habitat for CRLF on the site. Therefore, impacts are only considered minor beneficial. mitigation measure WLD-MM-4 (augmentation of additional breeding habitat at the Banducci site) would provide some suitable off-site habitat to which CRLF could emigrate.

Impact WLD-R12: Increased Salinity Levels and Effects on CRLF (Long-Term, Years 5 and 50)

CRLF cannot successfully breed or spend long periods of time in salty water. However, this species did evolve in a coastal environment where temporary saltwater intrusions are common, so they have the means to tolerate it for short periods of time. Typically frogs will move up out of the aquatic habitat that they are occupying in favor of cool shaded upland banks. Then when the salinity drops to within their tolerance levels, they will return to the water. As long as the periods of saltwater intrusion are short, adults and juveniles will persist. Tadpoles will likely perish under brackish conditions if they do not have a freshwater refuge.

Restoration Alternatives 1, 2: Negligible. CRLF habitat would continue to be located outside areas subject to saline influence.

Restoration Alternative 3: Moderate Adverse. Periodic saltwater intrusion could create brackish water conditions unfavorable to CRLF breeding. This could limit suitable breeding habitat to the immediate vicinity of the freshwater inflows of Redwood and Green Gulch Creeks. Mitigation measure WLD-MM-7 would at least allow adults to persist and would reduce this impact to a less-than-significant level.

Restoration Alternative 4: Moderate Adverse. This alternative is similar to Alternative 3, with potential for even longer periods with brackish and possibly unsuitable salinity levels. Mitigation measure WLD-MM-7 would at least allow adults to persist and would reduce this impact to a less-than-significant level.

Impact WLD-R13: Increased Predation on CRLF from Fish (Long-Term, Year 5 and 50)

Because several of the aquatic habitats are connected, particularly during high water events or periods of saltwater intrusion, there is the potential for predatory

fish species to move into CRLF and prey upon individuals. Removal of existing power lines near CRLF habitat will reduce potential bird predation.

Restoration Alternative 1: Negligible. Conditions would remain the same as baseline CRLF habitat would remain disconnected from open water habitat that is suitable for predatory fish species.

Restoration Alternative 2: Moderate Adverse. The amount of open water habitat would not differ significantly from the No Action Alternative. However, the new CRLF habitat would have connectivity to the Green Gulch tributaries, with resulting potential for predation. In addition, by Year 50 there would be a reduction in the amount of emergent vegetation by about 50%, which could push CRLF into more of the open water habitat, with resulting increased impacts from predation. This would be offset to some degree by the refugia provided by off-channel habitat in the upper pasture, which would be subject to periodic drying (approximately once every 3–4 years) to help ensure that fish populations do not establish and that predation is minimized. As such, this is considered a significant moderate impact. Mitigation measure WLD-MM-5, which includes monitoring for and removal of nonnative fish from within the watershed, would reduce impacts to a less-than-significant level.

Restoration Alternative 3: Moderate Adverse. The increase in open and deeper water habitat would increase the habitat suitability for fish that prey on CRLF. This problem would be more severe in Year 5 when there would be 6.2 acres of open water habitat. Over time and by Year 50, this problem would be less severe because the two lagoons would become filled with sediment, reducing habitat suitability for predatory fish. This is considered a moderate and significant impact. Implementation of mitigation measure WLD-MM-4, which would provide additional off-channel CRLF habitat that would not be subject to the same predation intensity, would reduce impacts to a less-than-significant level. Mitigation measure WLD-MM-5, which includes monitoring for and removal of nonnative fish from within the watershed, would also be beneficial.

Restoration Alternative 4: Major Adverse. The larger open water area provides extensive habitat for predatory fish in Year 5. The quantity of open water habitat would be slightly reduced by Year 50 because of sediment fill, but habitat would still remain suitable for predatory fish. This is considered a major significant impact. Implementation of mitigation measure WLD-MM-4, which would provide additional off-channel CRLF habitat that would not be subject to the same predation intensity, would reduce impacts to a less-than-significant level. Mitigation measure WLD-MM-5, which includes monitoring for and removal of nonnative fish from within the watershed, would also be beneficial.

Impact WLD-R14: Overall Effects on CRLF (Short- and Long-Term, Years 0, 5 and 50)

Impacts WLD-R7 through WLD-R13 discuss various mechanisms for effects on CRLF. This impact discussion provides an overall conclusion for each alternative.

Restoration Alternative 1: Moderate Adverse. In general, conditions would remain the same as under existing conditions. However, the change in extent of habitat as described in Impact WLD-R8 is of great concern, potentially resulting in a local population decline consistent with the threshold for a moderate significant adverse impact. Mitigation identified under Impact WLD-R8 would reduce impacts to minor.

Restoration Alternative 2: Negligible. As described above, this alternative would potentially result in an increase in the potential for predation. However, it would avoid disturbance to existing habitat and would increase the extent of on-site habitat. Some potential exists for adverse effects to CRLF, either due to unintended mortality due to construction in upland areas, and due to the gradual conversion of existing aquatic habitat to riparian habitat. Overall effects include both beneficial and adverse aspects, and are considered negligible on balance. Mitigation measures identified above would ensure impacts are not adverse.

Restoration Alternative 3: Moderate Adverse. As described under Impacts WLD-R7, WLD-R12, and WLD-R13, this alternative would potentially result in construction-related mortality of CRLF, as well as an increase in the potential for adverse effects related to predation and salinity due to the orientation and characteristics of the small lagoons. These effects would be offset somewhat by the beneficial effects identified under Impacts WLD-R8 and WLD-R11 related to increases in habitat extent and reduced fragmentation. However, beneficial effects would be only minor, and are overshadowed by the moderate adverse effects, which could potentially result in a local population decline consistent with the threshold for a moderate significant adverse impact. Mitigation measures identified above would reduce this impact overall to minor levels.

Restoration Alternative 4: Moderate Adverse. As described under Impacts WLD-R7, WLD-R12, and WLD-R13, this alternative would potentially result in construction-related mortality of CRLF, as well as an increase in the potential for adverse effects related to predation and salinity due to the orientation and characteristics of the large lagoon. These effects would be offset somewhat by the beneficial effects identified under Impacts WLD-R8 and WLD-R11 related to increases in habitat extent and reduced fragmentation. However, beneficial effects would be only minor, and are overshadowed by the moderate to major adverse effects, which could potentially result in threats to the continued existence of the local population, consistent with the threshold for a major significant adverse impact. Mitigation measures identified above would reduce this impact overall to minor levels.

Impact WLD-R15: Effects on Special-Status Bird Species (Long-Term, Years 5 and 50)

Impacts to special-status bird species range from noise and disturbance during construction to changes in the available habitats on site over the short and long term. Note that noise effects to wildlife are also discussed in Section 4.3.4.7 *Noise*.

Restoration Alternative 1: Negligible. Conditions would remain the same as baseline.

Restoration Alternatives 2, 3, 4: See Impacts WLD-R1 through WLD-R6. Effects on special-status bird species would be as described for common bird species under Impacts WLD-R1 through WLD-R6. Mitigation measures WLD-MM-1 and WLD-MM-2 will be implemented where applicable to reduce this impact to a less-than-significant level.

Impact WLD-R16: Effects on Known Northern Spotted Owl Breeding Territories (Short- And Long-Term, Years 0, 5 and 50)

The closest known occupied northern spotted owl territory is Kent Canyon, over 8,200 feet (2,500 meters) from the project area (Shoulders pers. comm.[b]). As such, construction activities are extremely unlikely to disturb breeding northern spotted owls during the restoration of the site. Also, long-term changes in the available habitats on the site as a result of the restoration activity are extremely unlikely to impact this species.

Restoration Alternatives 1, 2, 3, 4: Negligible.

Impact WLD-R17: Effects of Restoration on Transitional Monarch Butterfly Populations (Long-Term, Years 5 and 50)

The monarch butterfly populations in the restoration area have been described as transitional (Shoulders pers. comm. [c]). The area is likely important to the species resting and foraging between major movements. Though as many as 2,000 individuals have been documented in the area (Monroe 2004) large populations have failed to persist through storm events because the site is not well protected. These larger populations scatter during such disturbances and only smaller clusters return, which allows for the determination that this is not a critical overwintering area.

Restoration Alternatives 1, 2, 3, 4: Negligible. Because this area provides transition habitat rather than overwintering habitat for monarch butterflies, populations will be intermittent and more tolerant of short-term disturbance. Although monarch butterflies are sensitive to changes in their microclimate and dust, this impact is still seen as negligible because there are no known overwintering sites within the project area. Populations will likely adapt to long-term habitat changes and seek out suitable foraging habitat as needed.

Impact WLD-R18: Effects on Other Common Species of Wildlife (Short- And Long-Term, Years 0, 5 and 50)

A variety of common species of wildlife exist on the site, including newts, tree frogs, snakes, other small mammals, and occasional river otters. As part of NPS standard operation procedures, preconstruction surveys are conducted prior to construction, and wildlife is either relocated or encouraged to leave the area, minimizing the potential for construction-related mortality. Loss of habitat from construction, as well as long-term changes in habitat mosaics as a result of the restoration, could result in effects on populations of these species. However, in general, a suitable mix of habitat will exist for most, if not all, common species

currently found on the site. In addition, these species are not endangered, and plentiful habitat exists for these species elsewhere in the watershed and the region.

Restoration Alternative 1: Negligible. Actions would be unlikely to measurably affect populations of common wildlife species.

Restoration Alternatives 2, 3, 4: Minor Adverse. Some small but measurable effects could occur in populations of common species. However, populations will likely adapt to long-term habitat changes and occupy suitable habitat as needed.

Impact WLD-R19: Effects on Bats (Short- And Long-Term, Years 0, 5 and 50)

Several bat species that are federally listed as species of concern or are protected by the Migratory Bird Treaty Act could occur in the project area. Removal of hollow snags as part of restoration construction could have adverse effects on roosting habitat. In addition, changes in the extent of emergent marsh and open water could also affect bat species due to their function as foraging areas.

Restoration Alternative 1: Negligible. Actions would be unlikely to measurably affect populations of bats.

Restoration Alternatives 2, 3, 4: Minor Adverse. Some small but measurable effects could occur as a result of removal of snags associated with restoration. Long-term effects would be similar to existing conditions or beneficial where additional open water or emergent habitat is provided. Although impacts are considered less than significant, mitigation measure WLD-MM-8 would further reduce potential for adverse effects.

Public Access Alternatives

Table 4.3.2.2-2 summarizes the potential impacts of Public Access Alternatives to wildlife in the study area. The Public Access Alternatives are described in Chapter 2.

Table 4.3.2.2-2. Potential Wildlife Impacts from Public Access Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							
Impact	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	Mitigation Measure
WLD-P1: Construction-Related Disturbance to Nesting Birds, Including Special Status Species	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	WLD-MM-2 when necessary
WLD-P2: Changes in Mature Riparian Habitat for Riparian-Associated and Cavity-Nesting Birds, Including Special Status Species	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	WLD-MM-1
WLD-P3: Changes in Monarch Butterfly Overwintering Habitat	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
WLD-P4: Effects on Songbird Nesting Success Due to an Increase in Corvid Populations Facilitated by a Change in Public Access	Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	WLD-MM-9: Implement Measures to Prevent Increases in Corvid Populations
WLD-P5: Effects on Bats	Negligible	Negligible	Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	Minor Adverse/ Negligible	WLD-MM-8

Impact WLD-P1: Construction-Related Disturbance to Nesting Birds, Including Special Status Species (Long-Term, Years 5 and 50)

Construction of the Public Access Alternatives would involve the removal of riparian vegetation. This vegetation provides suitable nesting habitat for several species of migratory birds. Construction related noise may adversely impact breeding birds in close proximity to restoration activities.

Public Access Alternative A: Negligible. The current configuration and capacity of the parking lot would not change.

Public Access Alternatives B1–B5, C: Negligible. In accordance to the GGNRA Standard Operating Procedures for vegetation cutting and removal, operations and maintenance activities with the potential to disturb nesting birds are conducted outside of nesting season. Mitigation measure WLD-MM-2, conducting preconstruction bird surveys, would be implemented during occasions when the guidelines under the Standard Operating Procedures were not feasible.

Impact WLD-P2: Changes in Mature Riparian Habitat for Riparian-Associated And Cavity-Nesting Birds, Including Special Status Species (Long-Term, Years 5 and 50)

Different parking lot configurations will result in a range of mature riparian habitat removal from the site. None of the parking lot configurations will result in a significant decrease in riparian vegetation with respect to the amount of the habitat type that is available within the region.

Public Access Alternative A: Negligible. No change in mature riparian habitat.

Public Access Alternatives B1–B5, C: Negligible. Impacts on riparian-associated and cavity-nesting birds would be negligible; implementation of mitigation measure WLD-MM-1 would reduce any short-term effects for those alternatives that result in a loss of riparian vegetation.

Impact WLD-P3: Changes in Monarch Butterfly Overwintering Habitat (Long-Term, Years 5 and 50)

Monarch butterflies utilize several locations within the GGNRA as transition habitat from October through February. Monarchs primarily use these areas for foraging and resting and not necessarily for overwintering. Monarch butterflies are sensitive to dust and changes in their microclimate.

Public Access Alternatives A, B1–B5, C: Negligible. There are no known overwintering sites within the project area. The action alternatives would result in the loss of a few Monterey pines used by monarchs; this loss is not considered substantial with respect to the availability of this type of habitat with the GGNRA.

Impact WLD-P4: Effects on Songbird Nesting Success Due to an Increase in Corvid Populations Facilitated by a Change in Public Access (Long-Term, Years 5 and 50)

Corvid bird species (i.e., blackbirds and jays) live commensally with humans, often scavenging food that is left behind or overflow trash from garbage cans. While visitation is not anticipated to increase as a result of the project, improper trash management could result in increases in the corvid population. This can have an impact on other nesting songbird species as corvids also prey on the eggs and young of these species.

Public Access Alternative A: Negligible. There would be no change in public access to the site, and so no increase in the number of corvids is anticipated.

Public Access Alternatives B1–B5, C: Minor Adverse. Though there is not expected to be significant increases in number of visitors to the site as a result of the project, proper trash management remains important. mitigation measure WLD-MM-9 will be implemented to ensure that corvid populations do not increase if visitor numbers rise.

Impact WLD-P5: Effects on Bats (Short- And Long-Term, Years 0, 5 and 50)

Impact mechanisms would be as described for Impact WLD-R19.

Public Access Alternative A; Negligible. No actions would be taken that could affect bats.

Public Access Alternatives B1 and B2: Negligible. Minimal removal of vegetation that could serve as roosting habitat for bats would occur, and overall there would be a long-term increase in riparian habitat that could provide roosting sites.

Public Access Alternatives B3–B5, C: Minor Adverse. Some small but measurable effects could occur as a result of removal of riparian habitat associated with these alternatives. Although impacts are considered less than significant, mitigation measure WLD-MM-8 would further reduce potential for adverse effects.

Bridge Alternatives

Table 4.3.2.2-3 summarizes the potential impacts of Bridge Alternatives to wildlife and wildlife habitat in the study area. The Bridge Alternatives are described in Chapter 2.

Table 4.3.2.2-3. Potential Wildlife Impacts from Bridge Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	Mitigation Measure
Impact WLD-B1: Construction-Related Disturbance to Nesting Birds	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	WLD-MM-2 when necessary
Impact WLD-B2: Changes in Monarch Butterfly Habitat	Negligible	Negligible	Negligible	Negligible	Negligible	
Impact WLD-B3: Effects on Bats	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	WLD-MM-8

Impact WLD-B1: Construction-Related Disturbance to Nesting Birds (Long-Term, Years 5 and 50)

Construction activities would involve the removal of riparian vegetation during the initial clearing and grubbing stages of bridge construction. This vegetation provides suitable nesting habitat for several species of migratory birds. Construction-related noise may adversely impact breeding birds in close proximity to construction activities.

Bridge Alternative BR0: Negligible. If no action is taken, then nothing will change from baseline at the site.

Bridge Alternatives BR1-BR4: Minor Adverse. In accordance to the GGNRA Standard Operating Procedures for vegetation cutting and removal, operations and maintenance activities with the potential to disturb nesting birds are conducted outside of nesting season. Operating outside of the nesting season in would make this impact minor adverse. mitigation measure WLD-MM-2 would be implemented during occasions when the guidelines under the Standard Operating Procedures are not feasible.

Impact WLD-BR2: Changes in Monarch Butterfly Habitat (Long-Term, Years 5 and 50)

Monarch butterflies utilize several locations within the GGNRA as transition habitat from October through February. Monarchs primarily use these areas for foraging and resting and not necessarily for overwintering. Monarch butterflies are sensitive to dust and changes in their microclimate.

Bridge Alternative BR0: Negligible. If no action is taken, then nothing will change from baseline at the site.

Bridge Alternatives BR1-BR4: Negligible. There are no known overwintering sites within the project area. The action alternatives would result in the loss of a few Monterey pines used by monarchs; this loss is not considered substantial with respect to the availability of this type of habitat with the GGNRA.

Impact WLD-B3: Effects on Bats (Short- And Long-Term, Years 0, 5 and 50)

Impact mechanisms would be as described for Impact WLD-R19. In addition, the existing bridge could serve as habitat for bats; however, the new bridge would also be designed to be “bat friendly.”

Bridge Alternative BR0; Negligible. No actions would be taken that could affect bats.

Bridge Alternatives BR1–BR4: Minor Adverse. Some small but measurable effects could occur as a result of removal of riparian associated with these alternatives. Although impacts are considered less than significant, mitigation measure WLD-MM-8 would further reduce potential for adverse effects.

Fill Disposal Alternatives

Table 4.3.2.2-4 summarizes the potential impacts of Fill Disposal Alternatives to wildlife in at the Unused Reservoir Pit, the Upper Banducci Field and the Coastal Trail. Impacts of fill placement at Hamilton and Dias Ridge are not addressed here because they are or will be addressed in other NEPA documentation. The Fill Disposal Alternatives are described in Chapter 2.

Table 4.3.2.2-4. Potential Wildlife Impacts from Fill Disposal Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Unused Reservoir Pit	Upper Banducci Field	Hamilton*	Dias Ridge Trail*	Coastal Trail	Mitigation Measure
WLD-F1 Construction-Related Disturbance to Nesting Birds	Minor Adverse	Minor Adverse	NA	NA	Minor Adverse	WLD-MM-2 when necessary

Note:

* The analysis of fill placement on wildlife is not analyzed for Hamilton or the Dias Ridge Trail.

Impact WLD-F1: Construction-Related Disturbance to Nesting Birds (Short-Term, Year 0)

Any of the areas where vegetation would be cut or scraped prior to truck delivery or fill placement has the potential to support nesting birds, including migratory songbirds. Noise of truck operations or other heavy equipment used to contour the fill could also adversely impact breeding birds in close proximity.

Unused Reservoir Pit, Upper Banducci Field, Coastal Trail: Minor Adverse. In accordance with GGNRA Standard Operating Procedures for vegetation cutting and removal, operations and maintenance activities with the potential to disturb nesting birds are conducted outside of nesting season. Vegetation removal may be conducted in advance of the nesting season for activities that would take place during the nesting season. Mitigation measure WLD-MM-2 would be implemented during occasions when the guidelines under the Standard Operating Procedure are not feasible.

Mitigation Measures

Mitigation Measure WLD-MM-1: Preconstruction Surveys and Possible Installation of Nest Boxes

Before riparian areas are cleared, a count of mature trees with available cavities should be taken to roughly estimate the number of cavities being lost. If the survey and an analysis by a qualified individual demonstrates that inadequate habitat remains for cavity nesters, nest boxes will be erected to match, as closely as possible, the lost value. Should the findings of the surveys result in the conclusion that nest boxes are not necessary, this mitigation measure would not be needed.

Mitigation Measure WLD-MM-2: Conduct Preconstruction Bird Surveys

Any vegetation (i.e., trees, shrub, grasses) that is not removed within the timing window specified in the GGNRA Standard Operating Procedures for vegetation cutting and removal will be surveyed for active bird nest(s) prior to its removal inside of the nesting period. This will include all vegetation to be disturbed and any areas that will be used to access the site or stage equipment. If active nests are found, no restoration related activities will occur within 50 feet of the nest while it is active.

Mitigation Measure WLD-MM-3: Limit Construction Access Routes and Equipment Staging Areas and Conduct Preconstruction Surveys for CRLF in All Suitable Habitat That Will Be Disturbed by Construction

Construction access routes and equipment staging areas will be limited within the study area to the extent feasible. These access routes and all other areas to be disturbed by restoration activities will be surveyed for the presence of CRLF prior to the beginning of construction activities. These preconstruction surveys will be conducted within 48 hours of the beginning of ground disturbance and will be planned with a “one step ahead” approach relative to construction activities. All rodent burrows, leaf litter deeper than 2 inches, or other obvious refugia will be surveyed for the presence of the species. Once it is determined that no individuals are present, exclusion fencing will be erected and maintained around the construction areas to prevent CRLF from entering into the active construction area. The exclusion fence will be about 3.5 feet high and keyed into the subsurface about 6 inches deep. Exclusion fences used around existing frog habitat will be fitted with intermittent one-way entry devices to allow frogs to enter, but not exit, the protected area. These fences will be walked every morning to ensure that no frogs have become “stuck” or entangled during nighttime movements and all amphibians observed during these morning checks will be relocated to the nearest suitable aquatic habitat outside of the construction area. Any CRLF discovered will be relocated at least 1000 feet from the area of disturbance and released into suitable aquatic habitat by a ~~USFWS and DFG approved~~ biologist permitted under the Endangered Species Act Section 10(a)(1)(A).

Mitigation Measure WLD-MM-4: Augment CRLF Breeding Habitat

New emergent wetlands will be excavated to provide additional breeding habitat for CRLF. These wetlands will be sized and designed such that they can support a long-term, persistent population of CRLF. Under the action alternatives, since CRLF habitat would already be provided onsite, this additional pond would be provided upstream at the Banducci site prior to construction, and would be supported by groundwater and designed to facilitate successful CRLF breeding. Construction of this new 0.52-acre pond was completed at the Banducci Site in October 2007, and revegetation with native wetland species is currently underway.

Reintroduction of CRLF to the Banducci site will be carried out in coordination with USFWS to reestablish a viable breeding population at the Banducci site. Individuals will be relocated from a well-established population in an adjacent watershed, rather than from the local population, since it is so small. A strategy will be designed and implemented to ensure that the donor population is not adversely affected, the regional genetic integrity of CRLF is maintained, and that the newly established populations have the best chance to succeed.

Mitigation Measure WLD-MM-5: Implement Monitoring and Contingency Measures for CRLF

CRLF populations and habitat conditions (duration of inundation at breeding site and cover) will be monitored at the Big Lagoon site on an ongoing (annual) basis. CRLF habitat will be monitored for both predators (fish) and to confirm that the existing habitat is occupied by CRLF and/or new habitat is colonized by CRLF. The GGNRA will work with the San Francisco Zen Center to remove all nonnative fish from their lands and within NPS lands. Should fewer than two CRLF be sighted in two consecutive years following construction, NPS will implement WLD-MM-6.

Mitigation Measure WLD-MM-6: Reintroduce California Red-Legged Frog to Supplement Existing Population On Site

Reintroduction of CRLF will be undertaken in coordination with USFWS to reestablish a viable breeding population on the Big Lagoon site. Individuals will be relocated from a well-established population in nearby watersheds. A strategy will be designed and implemented to ensure that the donor population is not adversely affected, the regional genetic integrity of CRLF is maintained, and that the newly established populations have the best chance to succeed.

Mitigation Measure WLD-MM-7: Implement Measures to Protect CRLF from Temporary Saltwater Intrusion

Restoration Alternatives 3 and 4 will be designed to provide areas of upland refuge from saltwater intrusion into aquatic environments. These areas will have low shrub or tree cover sufficient to maintain cool damp soils and leaf litter during all seasons. Established riparian areas can provide this function if such areas are already present adjacent to potential CRLF breeding pools.

Mitigation Measure WLD-MM-8: Implement Measures to Protect Bat Populations

Preconstruction surveys for bat species will be conducted in areas of suitable habitat within the project area. For tree-roosting bats, all potential roost trees that must be removed will be surveyed and identified in the field, and the following procedures will be applied prior to felling: (1) trees will be removed under the warmest possible conditions practical, (2) sections of the exfoliating bark will be peeled off the tree gently to search for any roosting bats underneath, (3) noise and vibrations (e.g., striking the tree base) will be created on the tree itself. When cutting sections of the bole, if any hollows or cavities (such as woodpecker holes) are discovered, a biologist will carefully check for the presence of bats in those areas.

Mitigation Measure WLD-MM-9: Implement Measures to Prevent Increases in Corvid Populations

The site will be supplied with enough trash receptacles to serve average visitor numbers depending on the time of year. Receptacles will be wildlife proof with lids that will default to a closed position. Trash collection will be done at a rate commensurate with the number of visitors in the area. Signage will be placed to educate visitors regarding the effect litter can have to wildlife, particularly in a sensitive coastal ecosystem such as Big Lagoon.

4.3.2.3 Fisheries

Guiding Regulations and Policies

NPS Management Policies (National Park Service 2006a) provide a high level of protection for animal species listed as threatened or endangered by the Federal Endangered Species Act. Additionally, NPS Management Policies require park managers to ensure that NPS operations do not adversely affect endangered, threatened, candidate, or sensitive species and their critical habitats, within or outside NPS property, and park managers must consider federal- and state-listed species and other special-status species in all plans and NEPA documents (NPS-77 Natural Resource Management Guidelines).

The ESA and CESA define the plant and animal species that must be especially protected because of their imperiled status. These mandates list the protected animals as threatened or endangered, and protect habitat necessary to their continuance. The ESAs are administered by the following agencies.

- USFWS (ESA, terrestrial and freshwater species),
- NMFS (ESA, marine and anadromous fishes), and
- DFG (CESA).

The ESA requires federal agencies to consult with USFWS before taking actions that (1) could jeopardize the continued existence of any federally listed plant or animal species (e.g., listed as threatened or endangered) or species proposed for listing, or (2) could result in the destruction or adverse modification of critical or proposed critical habitat. Upon request, USFWS provided a list of species that must be considered for this document (U.S. Fish & Wildlife Service 2005).

Under NEPA, NPS is required to consider whether an action may violate federal, state, or local laws or requirements imposed for the protection of the environment. For this reason, species listed under the CESA (i.e., those considered endangered or threatened) by DFG are included in this analysis. Species proposed for listing in either of the two categories are also included.

Special-Status Fish Species

Restoration activities could adversely affect special-status fish species through direct disturbance of plants, animals, and their habitats. Even management actions designed to benefit habitat, such as restoration, can have inadvertent adverse effects on special-status fish species. For example, the project may result in changes in the areal extent of aquatic habitats for special-status fish species.

The following parameters were used to evaluate the consequences of the various alternatives on special-status fish species.

- The species affected and its degree of local, regional, national, and global rarity.
- The rarity of the genotype or subspecies, regionally, nationally, or globally.
- The number of individuals or proportion of the species range affected by the alternative.
- The response of the species to restoration or disturbance, on a population or subpopulation level.

The NPS Organic Act, which directs parks to conserve wildlife and other park resources unimpaired for future generations, is interpreted by the agency to mean that native animal and plant life should be protected and perpetuated as part of the park's natural ecosystem. Natural processes are relied on to control populations of native species to the greatest extent possible; otherwise they are protected from harvest, harassment, or harm by human activities.

The ESA (16 USV 1431 et seq.) mandates that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. If the National Park Service determines that an action may adversely affect a federally listed species, consultation with the U.S. Fish and Wildlife Service is required to ensure that the action will not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat.

CEQA requires the NPS to avoid, minimize, and mitigate negative impacts on special-status species. Special-status species are plants and animals that are legally protected under state or federal laws or other regulations, as well as species considered sufficiently rare by the scientific community to qualify for such listing. Special-status species include the following categories of animals:

- Animals listed or proposed for listing as threatened or endangered under the ESA or CESA.
- Animals that are candidates for possible future listing as threatened or endangered under ESA or CESA.
- Animals designated as species of special concern by DFG.
- Animals fully protected under the California Fish and Game Code.

The following definitions apply to ESA and CESA categories for special-status species.

- Federal endangered: Any species that is in danger of extinction throughout all or a significant portion of its national range.
- Federal threatened: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its national range.
- California endangered: Any species that is in danger of extinction throughout all or a significant portion of its range in the state.

- California threatened: Any species that is likely to become an endangered species with the foreseeable future throughout all or a significant portion of its state range.

Furthermore, the ESA may specify *critical habitat*—habitat necessary for the survival of a listed species, subspecies, or population—and may limit human activities in these designated areas.

Study Area

The study area for fisheries encompasses all aquatic habitats in the project area. The entire project area is defined in Chapter 2 and shown on Figure 2-1.

Analysis Thresholds

Potential effects of the proposed project on coho salmon, steelhead, and the tidewater goby are assessed qualitatively and quantitatively, based on site designs, hydrologic modeling of future site conditions, predicted extent and quality of habitat, and known thresholds for habitat suitability of these target species.

Because of the sensitivity of the species and habitat or timing of an impact, distinct thresholds were established for salmonid fish passage and rearing habitat. Specific numerical standards may be applied, as appropriate, for aspects of habitat. These aspects and relevant standards are listed below.

- Flow—Flow is assessed in the context of passage for adults and juvenile salmonids during critical life history stages, as discussed below under "Specific Analysis Discussion."
- Temperature—In northern California, both Welsh et al. (2001) and Hines and Ambrose (1998) found that coho salmon juveniles did not persist where the floating weekly maximum temperature exceeded 18.3°C for any length of time. Steelhead juveniles are less susceptible than coho to temperature increases; hence the lower temperature for coho will be used to define impact potential. NMFS (Spence et al. 1996) characterizes properly functioning conditions for adult salmonids as between 10° and 13.9°C, and temperatures from 13.9° to 15.5°C as "at risk."
- Habitat Availability—Areal extent of habitat for rearing is compared to the existing condition in determining whether the project improves, degrades, or does not change habitat availability. The assessment of the quality of habitat is specifically addressed below under "Specific Analysis Discussion."
- Sedimentation—For construction-related impacts, the threshold for impacts is considered to be exceedence of 100 mg/l of total suspended solids (TSS) above background over a 24-hour period (Lloyd 1987, Bash et al. 2001). Total suspended solids are defined as mineral and organic particles that are

suspended in the water column. High concentrations of TSS can affect fish by altering their behavior, physiology and habitat, which results in physiological stress and reduced survival rate (Bash et al 2001).

The following thresholds were used in determining impacts on special-status fish:

- **Negligible:** Alternative would not measurably (greater than 5% change) alter habitats for special-status species, nor create a measurable difference in the distribution and abundance of special-status species.
- **Minor:** Alternative would have perceptible effects on habitats of special-status species, but impacts would be localized in extent; changes in the distribution and abundance of special-status species would be short term and restricted to the project site
- **Moderate:** Alternative would have apparent and readily noticeable effects on habitats of special-status species, but impact would be localized in extent; changes in the distribution and abundance of special-status species would be moderate in intensity and restricted to the project site and sites immediately adjacent; changes in distribution and abundance of species may be permanent, unless (if adverse) actively managed.
- **Major:** Alternative would have substantial effects to habitats of special-status species, and impact would affect a significant portion of the Redwood Creek watershed; changes in the distribution and abundance of special-status species would be substantial and would affect a large geographic area; changes in distribution and abundance of these species would be irreversible, even (if adverse) with active management.

Specific Analysis Discussion

Tidewater Goby

All life stages of tidewater gobies are found at the upper end of lagoons in salinities less than 10 parts per thousand. Tidewater gobies are not presently found at the project site. USFWS (2005) has finalized its recovery plan for tidewater goby, which includes the reintroduction of tidewater goby populations in coastal lagoons in California. The recovery plan does not specifically identify Redwood Creek as a future introduction site. This Final EIS/EIR will qualitatively identify the potential for the project to meet the salinity criteria for the species at the 5- and 50-year thresholds, but will not discuss potential impacts, because the species would not likely be introduced if the finished project does not meet the species needs.

Coho Salmon/Steelhead

Coho and steelhead salmonids are listed together due to the similarities of life histories for both species. Both species are expected to occur at the project site, and the analysis will focus on the various life history stages of both species. Adult salmon migrate in from the ocean after the onset of winter rains, move through the brackish beach lagoons, and up the creek into the upper watershed to

spawn. In the spring the fry move downstream using the creek channel and, importantly, the spring floodplain for rearing and gaining size before migrating out to sea. Criteria for aspects of coho and steelhead life history requirements are as discussed in the thresholds presented above. In addition, the following thresholds were used in determining impacts on passage:

- **Negligible:** Alternative would not measurably alter the existing hydrology during periods of adult salmonid migration (November–April) nor come within 25 percent of minimum passage thresholds.
- **Minor:** Alternative would alter the existing hydrology during periods of adult salmonid migration (November–April) to come within 25 percent of minimum passage thresholds.
- **Moderate:** Alternative would alter the existing hydrology during periods of adult salmonid migration (November–April) to come within 5 percent of or meet minimum passage thresholds.
- **Major:** Alternative would alter the existing hydrology during periods of adult salmonid migration (November–April) to exceed minimum passage thresholds.

Methods and Assumptions

To determine impacts on special-status fish species, the following methods and assumptions were used.

- Park staff, through their best professional judgment based on direct observations and local data, provided information on special-status fish species in the study area.
- The map of existing habitat from the Feasibility Analysis (Philip Williams & Associates 2003) was consulted to assess potential impacts on special-status fish species in the project area.
- The following databases were consulted to generate a list of special-status species that could potentially occur in the project area.
  - The CNDDB (California Natural Diversity Database 2004) records for the Point Bonita USGS 7.5-minute quadrangle and the following five surrounding quadrangles: San Quentin, San Francisco North, San Francisco South, San Rafael, and Bolinas.
  - USFWS's (2005) special-status species list for the above USGS quadrangles.
- Field reconnaissance of project construction areas was conducted on January 16, 2005 of the entire project area, including parking lot alternatives by Jones & Stokes biologist Matthew Jones.
- Sensitive natural communities, special-status species, and areas of suitable habitat in the study area were mapped.

- Existing data on temperature, dissolved oxygen, and total dissolved solids collected in Redwood Creek during winter storm events was reviewed.
- The frequency of available winter floodplain habitat was calculated using a hydraulic model to compare conveyance capacities of the existing versus the design channel both upstream and downstream of Pacific Way (Philip Williams & Associates 2006).
- Expected winter rearing habitat areas were mapped at the project site based on:
  - estimates of winter flow conditions (base and winter storm flows) derived from historical flow data;
  - approximate areas of inundation for existing conditions based on available topographic mapping, hydraulic modeling results, supplemental hydraulic calculations, and visual observations; and
  - expected areas of inundation for proposed project conditions based on topographic mapping, preliminary design dimensions, and supplemental hydraulic calculations.

Impacts on critical habitats for coho salmon and steelhead have been assessed in a quantitative manner where possible. The assessment determines whether the wetland and creek restoration would be beneficial or detrimental to special-status fish populations. Key concerns about the project have been broken down into the categories of (a) passage, or the ability of adult fish to migrate from the ocean through the project site into the upper watershed for spawning, and (b) rearing habitat, or the ability of young fish to utilize the project site for feeding and resting before migrating out into the ocean. Other impacts have also been considered, as described below.

Passage

One primary limiting factor for anadromous fish in human-altered landscapes is the ability of adult fish returning from the ocean to migrate through coastal wetlands into upper-watershed spawning streams. Returning adults require adequate stream flow with appropriate seasonal timing. In order to evaluate the potential effects of the action alternatives on fish passage, the following parameters were considered. Methods used to define the parameters are discussed under each parameter.

- Minimum passage requirements for adult coho and steelhead are usually set at a minimum stream depth of 0.8 feet, with a water velocity not exceeding 6 feet per second (fps) over a distance no greater than 60 feet (California Department of Fish and Game 2003, Washington Department of Fish and Wildlife 2003).
  - These metrics are based on the burst speed potential of the species and the distance the species can cover before rest is necessary in deeper,

slower velocity habitats. The metrics listed are based on the most recent and relevant studies and guidelines approved by DFG and the Washington Department of Fish and Wildlife.

- Flow modeling based on site-specific landform data and historic stream flow data has predicted depths and flows in the channel under each alternative and the existing condition during periods of adult salmonid migration (November–April) (see Appendix E). The assessment compares each alternative to the minimum passage requirements discussed above and to the existing condition to determine the intensity of the impact as outlined in the "Analysis Thresholds" section above.

Rearing Habitat

For juveniles, the project area is the transitional zone from a freshwater rearing stream to the marine environment. The project site provides both summer-fall and winter-spring rearing habitat for salmonids, as discussed below. Because characteristics of summer-fall and winter-spring habitat differ slightly, they will be described and evaluated separately.

Summer-Fall Rearing Habitat

Coho and steelhead juveniles utilize summer-fall rearing habitat at the project site before the fish migrate to sea. The evaluation of summer-fall rearing habitat is based primarily on the relative amount of suitable open water habitat available within the project site under each alternative. The following methods are used to define that parameter.

In estuarine areas, visual observations of juvenile salmonid use in Central California coast region by NOAA researchers have found highest numbers of juvenile salmonids associated with deep water and instream structures (Freund pers. comm.). In upstream, freshwater habitats, deep pools with instream and bank cover (e.g. instream logs, overhanging vegetation) provide instream refuge from temperature and predators during summer low flow events.

The areal extent of these habitats can increase the productivity and survival of coho and steelhead. Higher gradient habitats such as riffles and flatwaters are important for invertebrate production, although the project is in a low gradient area, and these habitats are generally lacking. The areal extent of increase or decrease of deep pools over the existing condition will be qualitatively considered within the context of general habitat suitability.

Winter-Spring Rearing Habitat

Winter-spring rearing habitat is evaluated in terms of both base flow and peak flow conditions. Bell (2001) surmises ideal habitat unit for over-wintering juvenile coho salmon in freshwater habitat may be deep, slow water, main channel pools that can support a large population at winter base flows, with adjacent off-channel habitat for refuge during high flows. Although limited information is available for estuarine areas, Maser and Sedell (1994) note that

shelter from spring freshets and tidal flushing may be afforded by large, stable instream-driftwood.

Highest densities of juvenile coho have been found in main channel pools and backwater areas characterized by low velocities (Bell 2001). Preferred velocities during the winter are generally less than 30 centimeters per second (cm/s) (Tschaplinski and Hartman 1983). Juvenile coho also exhibit a preference for structurally complex cover (McMahon and Hartman 1989) and deep habitats (>50 cm) Reeves et al. (1989). The evaluation of baseflow winter rearing habitat is based primarily on the amount of low velocity, complex main channel and backwater pool habitats available in the stream and the amount of low velocity, complex lagoon habitat.

Under peak winter flow conditions, juvenile coho need to find shelter to avoid being swept downstream or killed. Adjacent floodplain habitats can provide refugia under such conditions as well as protected main channel locations with stable, complex structures. Coho escape to slow-flowing backwater areas, side-channels, floodplains, and wetlands (commonly greater than or equal to 45 cm in depth) (McMahon 1983). The evaluation of winter peak flow habitat will be based primarily on the availability of low velocity off-channel habitat, such as alcoves, side channels, and floodplains next to good winter base-flow habitat. The availability of off-channel habitat will be assessed using the frequency of connectivity, duration, and extent. High frequency of connectivity would allow for more opportunities for use by salmonids as well as minimizing stranding risk by offering multiple opportunities to leave. Long duration of inundation and wide extent afford a greater capacity to accommodate fish as well as providing foraging opportunities (Minakawa and Kraft 1999). Winter floods are important mechanisms for food supply in small, coastal California streams; fish collected in floodplain and inundated vegetated had high stomach fullness (Pert 1993).

The modeled or predicted habitat conditions for these above-listed parameters at Years 0, 5, and 50 has been qualitatively and quantitatively compared to existing conditions at the site in order to define the extent of potential negative or beneficial impacts any given alternative may have on rearing habitat availability at the project site.

Other Impacts

Other potential impacts on salmonids could include but are not limited to excess fine sediment releases, contaminant spills, temperature impacts, and alteration of the salinity gradient. These factors are qualitatively assessed for intensity of impacts on fish species at Years 0, 5, and 50. Methodologies for assessing these factors are relatively simple or are well defined in primary literature.

Restoration Alternatives

Table 4.3.2.3-1 summarizes the potential impacts of Restoration Alternatives to fisheries in the study area. The Restoration Alternatives are described in Chapter 2.

Table 4.3.2.3-1. Potential Impacts of Restoration Alternatives on Study Area Fisheries

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				
Impact	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	Mitigation Measure
FISH-R1: Increased Turbidity in Redwood Creek During Construction	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	Water Quality Mitigation Measures WQ-MM-1, WQ-MM-2, WQ-MM-3 and WQ-MM-4
FISH-R2: Accidental Release of Construction-Related Hazardous Materials	**Moderate Adverse**/ Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Water Quality Mitigation Measure WQ-MM-2
FISH-R3: Increased Water Temperatures in Redwood Creek Following Construction	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	FISH-MM-1: Riparian Shade Mitigation and Monitoring
FISH-R4: Increase in Nutrients and Decrease in Dissolved Oxygen Levels Immediately Following Construction	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
FISH-R5: Increased Turbidity and Sedimentation in Redwood Creek Following Construction	Minor Adverse	Negligible	Negligible	Negligible	
FISH-R6: Fish Passage Barriers Due to Channel Design and Aggradation During the Project's Lifetime	**Moderate Adverse**	Minor Beneficial	Minor Beneficial	Minor Beneficial	No Action Alternative: no mitigation available
FISH-R7: Fish Entrapment Due to Out-of-Bank Flows and/or Channel Avulsion During the Project's Lifetime	**Major Adverse**	Minor Beneficial	Moderate Beneficial	Moderate Beneficial	No Action Alternative: no mitigation available
FISH-R8: Effects on Summer-Fall Juvenile Salmonid-Rearing Habitat	Minor Adverse	Minor Adverse	Minor Beneficial	Minor Beneficial	

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
Immediately Following Construction					
FISH-R9: Effects on Summer-Fall Juvenile Salmonid-Rearing Habitat During Early Phases of Ecosystem Establishment	Minor Adverse	Minor Beneficial	Minor Beneficial	Moderate Beneficial	
FISH-R10: Effects on Juvenile Summer-Fall Salmonid–Rearing Habitat During Later Phases of Ecosystem Establishment	Minor Adverse	Negligible	Negligible	Moderate Beneficial	
FISH-R11: Effects on Juvenile Winter-Spring Salmonid–Rearing Habitat Immediately Following Construction	Minor Adverse	Minor Beneficial	Minor Beneficial	Minor Beneficial	FISH-MM-2: Optimization of Winter Rearing Habitat
FISH-R12: Effects on Juvenile Winter-Spring Salmonid– Rearing Habitat During Early Phases of Ecosystem Establishment	Minor Adverse	Minor Beneficial	Moderate Beneficial	Moderate Beneficial	FISH-MM-2
FISH-R13: Effects on Juvenile Winter Salmonid– Rearing Habitat During Later Phases of Ecosystem Establishment	Minor Adverse	Minor Beneficial	Minor Beneficial	Minor Beneficial	FISH-MM-2

Impact FISH-R1: Increased Turbidity in Redwood Creek During Construction (Short-Term, Years 0, 5 and 50)

This impact would be caused by the release of construction-related fine sediment from channel grading, access roads, staging areas, ground-disturbing activities and stockpiles. Once in the stream channel, mobilized sediments can result in direct impacts to resident fishes through gill damage and reduced capacity to intake oxygen. Indirect impacts can include reduced fitness as a result of decreased DO intake ability; increased metabolic costs associated with reduced DO intake ability, and reduced foraging ability as the result of decreased visibility. The threshold for impacts is considered to be an exceedence of 100 mg/l of total suspended solids above background over a 24-hour period (Lloyd

1987, Bash et al. 2001). These impacts could occur both as a result of the restoration project as well as from periodic maintenance activities as necessary.

Future activities in the watershed above the project area also have a low probability of contributing turbidity to Redwood Creek; for this reason, impacts are considered cumulative.

Restoration Alternative 1: Moderate Adverse. Periodic maintenance dredging could release sediment. If timed during summer low-flow conditions, dredging would have minimal effect on summer juvenile salmonid rearing habitat, but turbidity could exceed 100 mg/l of TSS above background in a 24-hour period, which could reduce fitness of coho and steelhead but would not result in lethal effects in adults. This impact is considered moderate and potentially significant. Water quality mitigation measures WQ-MM-1, WQ-MM-2, WQ-MM-3, and WQ-MM-4 would reduce this impact through the implementation of best management practices to reduce the potential for release of sediment to water bodies.

Restoration Alternative 2, 3, 4: Moderate Adverse. Impacts associated with the interim flood reduction measures would be similar to the periodic maintenance dredging activities described above under Restoration Alternative 1.

Under the restoration actions, a large portion of the project site would be subject to ground-disturbing activities during construction. The amount of ground disturbance would be greater for the more intensive alternatives (e.g., the small and large lagoon alternatives). Turbidity could exceed 100 mg/l above background in any 24-hour period, which could reduce fitness of coho and steelhead but would not cause lethal effects in adults or juveniles. These effects during construction would be expected primarily when portions of the new channel are connected to the old channel, or when specific in-channel actions are conducted, such as the removal of rock gabions. Relocating fish in the affected areas before channel work commences, or channel connections are made, would minimize the potential for impacts. GGNRA's standard protocol calls for collection and relocation of any native fish from channel segments immediately prior to construction. Flows would be re-established and fish would not be allowed to re-enter until turbidity returned to normal levels. Timing of in-channel construction would be limited to the dry season. However additional soil stabilization would need to be conducted to protect juveniles potentially rearing in project area pools in the vicinity of construction activities. Turbidity is not expected to increase by 200 mg/l for 24-hours or more, the point at which lethal effects would begin to appear in steelhead (Newcombe and MacDonald 1991, Bash et al. 2001).

This impact is considered moderate and potentially significant; however, WQ-MM-1, WQ-MM-2, WQ-MM-3, and WQ-MM-4 would reduce this impact below significance thresholds through the implementation of best management practices to reduce the potential for release of sediment to water bodies.

Impact FISH-R2: Accidental Release of Construction-Related Hazardous Materials (Short-Term, Year 0)

This impact could be the result of the accidental spillage of chemical contaminants (commonly limited to petroleum-based products) used by construction equipment operating in the project area. Accidental spills can occur through the breakage of construction equipment and/or as the result of accidents during contaminant transfer. Contaminants can have a variety of potential lethal implications, including direct mortality of fish and their eggs, or indirect impacts on physiological function that reduce the overall fitness of fish and their eggs.

Restoration Alternative 1: Moderate Adverse. Periodic maintenance dredging could release construction-related hazardous materials. Dredging could occur multiple times during the 50-year planning horizon, but it would be short term in nature. Even if materials were released at levels lethal to coho and steelhead, project timing would be limited to the dry season and likely protect the population from major adverse effects. However, this impact is considered moderate and potentially significant. Implementation of water quality mitigation measures WQ-MM-2 would reduce this impact through the implementation of a spill prevention and protection plan that would outline measures to reduce the potential for spill and isolate accidental spills should they occur. The plan would also identify and limit areas of contaminant storage and transfer to outside of sensitive aquatic habitats.

Restoration Alternative 2, 3, 4: Minor Adverse. Impacts associated with the interim flood reduction measures would be similar to the periodic maintenance dredging activities described above under Restoration Alternative 1.

Similarly, under the restoration actions, construction could lead to releases of fuels, oils, and other construction-related hazardous materials, which could reach surface or groundwater. Accidental spills from construction equipment could also result in increased contaminant levels. Even if materials were released at levels lethal to coho and steelhead, project timing would be limited to the dry season and likely protect the population from major adverse effects. In addition, implementation of water quality mitigation measure WQ-MM-2 would reduce this impact through the implementation of a spill prevention and protection plan that would outline measures to reduce the potential for spill and isolate accidental spills should they occur. The plan would also identify and limit areas of contaminant storage and transfer to outside of sensitive aquatic habitats.

Impact FISH-R3: Increased Water Temperatures in Redwood Creek Following Construction (Short-Term, Year 5)

As discussed above, studies have found that coho salmon juveniles did not persist where the floating weekly maximum temperature exceeded 18.3°C for any length of time. Steelhead juveniles are less susceptible than coho to temperature

increases; hence the lower water temperatures for coho are used to define impact potential. The key elements responsible for increases in water temperature that could be altered as the result of the proposed alternatives are flow and riparian cover (i.e., shade). While flow may be altered to some degree by the project, either through changed project features or altered groundwater levels during the dry season, the project area is at the mouth of the watershed, and flows are anticipated to be dominated by upstream inputs from the watershed rather than local flow characteristics of the channel. For this reason, temperature impacts arising from altered flows as a result of the Restoration Alternatives are not considered further. Hence, any potential increases in stream temperatures will be the result of local channel morphology (e.g., presence of deep pools), riparian cover densities and the areal extent of riparian cover. Water temperatures are generally anticipated to be within the current range of interannual variation resulting from climatic factors.

Restoration Alternative 1: Negligible. Periodic dredging would not substantially affect riparian cover or other factors related to in-stream temperatures.

Restoration Alternative 2, 3, 4: Minor Adverse. The interim flood reduction measures would not substantially affect riparian cover or other factors related to in-stream temperatures. Under the restoration actions, during the first year following construction, riparian cover would likely be insufficient to provide substantial shade in the lower portions of the site and could lead to slightly increased water temperatures over the existing condition, particularly during low-flow periods such as late summer. While an active revegetation program would be implemented such that riparian vegetation would be present immediately following construction, this vegetation would not be mature and is not anticipated to provide the same level of shading as mature riparian vegetation. Riparian species would grow rapidly, and as a result this impact would only persist for the first few years following completion of the restoration.

Although temperature refuge does exist upstream of the project area for juveniles, an increase in temperatures as a result of reduced shade could exceed regulatory standards (i.e., an increase of 5 ºF or more). This pressure could result in reduced fitness over the construction seasons and following seasons (functionally equivalent to several drought seasons in a row) with the impact lessening between years 2–5 and likely matching current conditions by Year 5 (assuming conservative growth of riparian trees). This could reduce the success of 3–4 year classes as the project area stabilizes, assuming a worst conservative recovery of the site, but it would not result in direct lethal effects on juveniles.

Despite the potential issues described above, past data has shown that water temperatures in unshaded areas generally remain within acceptable levels due to the cool, foggy summers at the Big Lagoon site. As such, impacts are considered minor overall. Mitigation measure FISH-MM-1 would reduce this impact.

Impact FISH-R4: Increase in Nutrients and Decrease in Dissolved Oxygen Levels Immediately Following Construction (Short-Term, Year 5)

Construction-related earthwork would expose previously sequestered soil nutrients and disturb aquatic and riparian vegetation that shade the water column, potentially resulting in increased nutrient levels in Redwood Creek and the downstream lagoon, potential for nuisance growths, and consequent fluctuations in dissolved-oxygen levels. Dissolved oxygen levels below 5 mg/l could result in reduced fitness of coho and steelhead juveniles rearing in the project vicinity.

Restoration Alternative 1: Negligible. Periodic dredging is not anticipated to measurably affect nutrient cycles.

Restoration Alternative 2, 3, 4: Minor Adverse. The interim flood reduction measures are not anticipated to measurably affect nutrient cycles.

For the restoration actions, impacts are anticipated to be fairly similar across alternatives. The lagoons under Alternatives 3 and 4 may have more standing water and less flushing than under Alternative 2, with increased potential for adverse impacts. However, as soils and vegetation in the lagoons develop, these adverse impacts would be offset by the natural water quality treatment functions that these water bodies provide. Additionally, winter storms in the first year following construction would flush excess nutrients from the system and allow for the stabilization of nutrients in the project area. All action alternatives could result in temporary, localized DO levels below 5 mg/l, leading to reduced fitness within juvenile summer habitat in the period immediately following construction. However, it is difficult to determine whether DO levels would indeed have excursions below this threshold as a result of the project, and the potential for this to occur is considered low.

Impact FISH-R5: Increased Turbidity and Sedimentation in Redwood Creek Following Construction (Short-Term, Year 5)

This impact would be caused by the release of fine sediment during the first few years after the restoration project is completed, as the channel becomes established and coarse material is washed into the streambed.

Mobilized sediments can result in direct impacts to resident fish through gill damage and reduced capacity to intake oxygen. Indirect impacts can include reduced fitness and increased metabolic costs associated with reduced oxygen intake ability, reduced foraging ability as the result of decreased visibility, and potential for smothering of fish habitat. The threshold for impacts is considered to be an exceedence of 100 mg/l of TSS above background over a 24-hour period (Lloyd 1987, Bash et al. 2001).

Restoration Alternative 1: Negligible. Periodic maintenance activities are not anticipated to result in substantial changes in turbidity in the years following maintenance.

Restoration Alternative 2, 3, 4: Minor adverse. Interim flood reduction measures are not anticipated to result in substantial changes in turbidity in the years following maintenance.

Under the restoration actions, elevated turbidity levels, potentially in excess of 100 mg/l above background in a 24-hour period, could exist during the first two years immediately following construction. These elevated levels could reduce fitness of coho and steelhead, but they would not result in lethal effects in adults and juveniles.

Impact FISH-R6: Fish Passage Barriers Due to Channel Design and Aggradation During the Project's Lifetime (Long-Term, Years 5 and 50)

The reach of Redwood Creek in the vicinity of the project is a known depositional reach that now collects sediment (resulting from increased anthropogenic inputs), currently causing increased frequency of out-of-bank flows and potential avulsion of the channel. While the restoration activities would make alterations to the channel location, form, and gradient throughout the project reach that would improve sediment passage, the ability to fully alter the channel gradient such that all sediment passes through the system is limited by the upstream and downstream limits on channel elevation (i.e., the Hwy 1 culvert and the Pacific Ocean). As a result, the project area, particularly the reach downstream of the Pacific Way Bridge, is anticipated to remain depositional. This could result in channel aggradation (i.e., widening and shallowing of the active channel) over time. In addition, periodic episodic events (e.g., large storms, fires in the watershed) could cause increases in sediment delivery or other geomorphic changes such as debris jams that could impede fish passage. While this is the case for all alternatives, including the No Action alternative, all of the Restoration Alternatives would result in a more uniform channel form and gradient, thus improving sediment passage and reducing the potential for such effects. The existing levee road obstructs fish passage to the floodplain because it is 1,300 feet in length with only two small culverts connected to the creek..

The following analysis of passage viability is based on calculations of depth and velocity within the project reaches under each alternative calculated using a MIKE-11 network model (Appendix E; described in more detail in the Watershed Processes section).

Restoration Alternative 1: Moderate Adverse. Minimum passage thresholds are not met intermittently throughout the migration period in three channel segments identified in the MIKE-11 network model. This situation would generally persist or worsen for the life of the project and would require periodic

maintenance dredging in order to mitigate for channel aggradation and loss of passage for coho and steelhead.

PWA (2005) evaluated the potential fish passage conditions should Redwood Creek abandon its existing channel and permanently relocate to the low point of the valley. This has been termed the “Swampy Meadow” scenario, under which no defined channel would exist for some time after channel avulsion. The conclusion of this investigation is that fish passage would be more difficult than at present. In most years there would probably be sufficient depth for adult in-migration and outmigration of juveniles, but there would be fewer passable events per season than at present.

While periodic maintenance dredging may reduce the potential for such channel avulsion, it is difficult to predict whether channel avulsion would occur. This impact is considered a potentially significant and unavoidable consequence of the No Action alternative.

Restoration Alternative 2: Minor Beneficial. Construction of low berms along the edges of the channel would improve retention of thalweg and maintenance of conditions for passage. Significant improvements would be seen in channel depth in the lower project area, but would be tempered by negligible gains and losses in channel depth in the rest of the project. Modeled fish passage improvements (i.e., increased channel depth compared to existing conditions at the same channel station) would outweigh losses , and water depth would not be reduced by more than 5% of the existing condition at any location. Minimum passage thresholds would be met during the migration period throughout the project area. However, as described above, over the long term, episodic events or sediment deposition over time may result in the need for some maintenance to sustain fish passage. Realignment of the channel and other channel design features (e.g., uniform channel gradient, berms) would reduce this potential, and the restoration is considered an improvement over existing conditions.

Restoration Alternative 3, 4: Minor Beneficial. Construction of berms would allow retention of thalweg and maintenance of passage. Significant improvements would be seen in channel in the lower project area, but they would be tempered by negligible gains and minor losses in channel depth in the rest of the project. Modeled fish passage improvements would outweigh losses. Water depth would be reduced by more than 5% of the existing condition in an 800-ft segment at and upstream of the lagoons. However, minimum passage thresholds would be met during the migration period throughout the project area.

As described above, over the long term, episodic events or sediment deposition over time may result in the need for some maintenance to sustain fish passage. The lagoons under these alternatives would serve as sediment traps and may reduce the potential for channel aggradation. In addition, realignment of the channel and other channel design features (e.g., uniform channel gradient, berms) would reduce this potential, and these alternatives are considered an improvement over existing conditions.

Impact FISH-R7: Fish Entrapment Due to Out-of-Bank Flows and/or Channel Avulsion During the Project's Lifetime (Long-Term, Years 5 and 50)

As previously described, the reach of Redwood Creek in the vicinity of the project is a known depositional reach that now collects sediment (resulting from increased anthropogenic inputs), currently causing increased frequency of out-of-bank flows and potential avulsion of the channel. While the restoration activities would make alterations to the channel location, form, and gradient throughout the project reach that would improve sediment passage, the ability to fully alter the channel gradient such that all sediment passes through the system is limited by the upstream and downstream limits on channel elevation (i.e., the Hwy 1 culvert and the Pacific Ocean). As a result, the project area, particularly the reach downstream of the Pacific Way Bridge, is anticipated to remain depositional. This could result in channel aggradation (i.e., widening and shallowing of the active channel) and more frequent out-of-bank flows, or even channel avulsion, over time. In addition, periodic episodic events (e.g., large storms, fires in the watershed) could cause increases in sediment delivery or other geomorphic changes such as debris jams that could lead to increased frequency of out-of-bank flows or channel avulsion. Indeed, the Restoration Alternatives have low berms along the edge of the channel for periodic out-of-bank flows approximately once per year.

While this is the case for all alternatives, including the No Action alternative, all of the Restoration Alternatives would result in the channel being relocated to the low point of the valley, as well as a more uniform channel form and gradient, improving sediment passage and reducing the potential for increased out-of-bank flows over time or channel avulsion. Regardless, out-of-bank flows could result in fish becoming entrained behind berms, and therefore susceptible to entrapment and mortality as flood flows recede. In addition, channel avulsion could result in conditions without a clearly defined stream channel, resulting in similar potential for entrapment and mortality.

Restoration Alternative 1: Major Adverse. As described in the Impact FISH-R6 impact discussion, potential under the no-action alternative exists for increased frequency of out-of-bank flows as the channel continues to aggrades, resulting in increased potential for fish to become entrained outside of the channel, with no way of returning to the channel should culverts become plugged. This impact could potentially be mitigated with implementation of a rescue program or through emergency cleaning of culverts to create flow pathways back to the active channel.

In addition, under the "swampy meadow" scenario, channel avulsion could lead to absence of a clearly defined stream channel, also leading to potential for fish mortality if they were to become entrapped in the meadow as flows recede. PWA (2005) concluded that if avulsion occurred, it would probably result in a slowly evolving site in which some portions of the upper floodplain would re-establish a dominant channel, but portions of the lower floodplain could persist as a swampy meadow for considerable periods of time, possibly indefinitely. Channel

formation could be stimulated through intervention, by either creating a channel in the meadow (possibly in advance of an avulsion) or by notching the lower meadow to create a preferential flow path back to Redwood Creek near the parking lot that can initiate a headcut from the channel back into the meadow. While periodic maintenance dredging may reduce the potential for such channel avulsion, it is difficult to predict whether channel avulsion would occur. This impact is considered a potentially significant and unavoidable consequence of the No Action alternative.

Restoration Alternative 2: Minor Beneficial. Potential for entrapment behind berms is anticipated to be rare because multiple re-entry points are designed through the backwaters for fish caught in any potential flood overflow. The channel berms downstream of the Pacific Way Bridge will be discontinuous or absent and low enough to allow overflow in a one-year flow event, and ponding on the floodplain is likely to be frequent. Channel avulsion of this channel design is considered of lower likelihood than under existing conditions. Potential for impacts could be addressed with implementation of a rescue program, or in the case of severe issues associated with channel avulsion, through intervention activities (e.g., maintenance dredging to re-establish a dominant channel).

Restoration Alternative 3: Moderate Beneficial. Potential for channel avulsion or entrapment behind berms would likely not result in fish entrapment due to flow recapture in lagoons. Rare potential for impacts could be addressed with implementation of a rescue program, or in the case of severe issues associated with channel avulsion, through intervention activities (e.g., maintenance dredging to re-establish a dominant channel).

Restoration Alternative 4: Moderate Beneficial. Potential for channel avulsion or entrapment behind berms would likely not result in fish entrapment due to flow recapture in the large lagoon. Rare potential for impacts could be addressed with implementation of a rescue program, or in the case of severe issues associated with channel avulsion, through intervention activities (e.g., maintenance dredging to re-establish a dominant channel).

Impact FISH-R8: Effects on Summer-Fall Juvenile Salmonid-Rearing Habitat Immediately Following Construction (Short-Term, Year 0)

Open water areas and pools provide in-stream temperature refuge from potential stressful and lethal temperature increases during the summer low flows. The areal extent of these habitats can increase the productivity and survival of juvenile coho and steelhead rearing in lower Redwood Creek. Deep pools are known to be key habitats for these species and the availability of such habitat following construction will impact post-project survival of juvenile coho and steelhead.

Restoration Alternative 1: Minor Adverse. Rearing habitat would not be altered and would exist in deep pools as currently exists. Periodic maintenance dredging could result in a reduction in habitat complexity in the areas where

work is conducted, as a result of removal of LWD, more consistent grading of the channel that removes deep pools, etc. However, these effects are anticipated to be short-term, as habitat complexity will quickly reestablish through sediment deposition patterns and LWD recruitment, and effects would be limited to a small portion of the overall project site. Indirect effects of necessary maintenance dredging could also include increases in stream temperatures associated with vegetation removed for access and dredging activities. Dredging activities will also require the relocation of coho and steelhead that are rearing in the dredging area. Relocation of coho and steelhead can result in crowding, increased competition, reduced feeding opportunities and can lead to an overall reduction of fitness and growth of rearing juvenile coho and steelhead.

Restoration Alternative 2: Minor Adverse. The interim flood reduction actions could result in a reduction in habitat complexity in the areas where work is conducted, as a result of removal of LWD, more consistent grading of the channel that removes deep pools, etc. However, these effects are anticipated to be short-term, as habitat complexity will quickly reestablish through sediment deposition patterns and LWD recruitment, and effects would be limited to a small portion of the overall project site. Long-term impacts would also be avoided since the restoration actions would occur within several years following the interim actions.

Under the restoration, newly created habitat would provide additional areal extent, but habitat quality would be temporarily degraded by sediment input and temperature increases due to the presence of immature riparian vegetation. Due to unstable site conditions, it may be possible that juveniles would not utilize the project area in Year 0, and this is considered a minor adverse impact.

Restoration Alternative 3, 4: Minor Beneficial. The effects of the interim flood reduction measures would be as described under Restoration Alternative 2. Under the restoration actions, newly created habitat would provide additional areal extent under both alternatives, which would provide additional deep pool refuge, despite temporary degradation due to post-construction sediment input and temperature increases due to the presence of immature riparian vegetation. This additional deep pool refuge would represent an improvement over the existing channel condition.

Impact FISH-R9: Effects on Summer-Fall Juvenile Salmonid-Rearing Habitat During Early Phases of Ecosystem Establishment (Short-Term, Year 5)

Impact mechanisms would be similar to those described above under Impact FISH-R8.

Restoration Alternative 1: Minor Adverse. Rearing habitat would not be altered and would exist in deep pools and cover as currently exists. Some LWD could accumulate in the lower watershed but could be lost in conjunction with necessary channel dredging activities. As described above under Impact FISH-

R8, such habitat would quickly recover. Indirect effects of necessary maintenance dredging could also include increases in local stream temperatures and reduced fitness of coho and steelhead relocated during dredging activities.

Restoration Alternative 2: Minor Beneficial. Summer-rearing habitat would increase as a result of the remnant side channels, which could include pool habitat. Main channel habitat would be improved by LWD that would be placed and would accumulate in the lower watershed, maintaining pool depths and providing additional cover habitat for juveniles.

Restoration Alternative 3: Minor Beneficial. Summer-rearing habitat would be increased by the new lagoons providing additional deep pool refuge. Although the placement of the lagoons off the main flow would result in increased temperatures in comparison to the main channel, the lagoons would represent an increase in viable rearing habitat. Additional LWD would be placed, providing additional cover habitat for juveniles. Temperatures would stabilize with added riparian cover.

Restoration Alternative 4: Moderate Beneficial. Rearing habitat would be increased appreciably with the new mainstem lagoon providing significant deep pool refuge. The lagoons would represent a substantial increase in viable rearing habitat. Additional LWD would be placed, providing additional cover habitat for juveniles. Temperatures would stabilize with added riparian cover.

Impact FISH-R10: Effects on Juvenile Summer-Fall Salmonid–Rearing Habitat During Later Phases of Ecosystem Establishment (Long-Term, Year 50)

Impact mechanisms would be similar to those described above under Impact FISH-R8.

Restoration Alternative 1: Minor Adverse. Rearing habitat would not be altered and would exist in deep pools and cover as currently exists. Some LWD could accumulate in the lower watershed but could be lost in conjunction with necessary channel dredging activities. Indirect effects of necessary maintenance dredging could also include increases in local stream temperatures and reduced fitness of coho and steelhead relocated during dredging activities.

Restoration Alternative 2: Negligible. Summer rearing habitat would have a tendency to return to existing conditions over time, as the remnant side channels fill with sediment and become isolated from the active channel. It is possible that channel migration over time could result in the formation of new side channels or oxbows. Additional LWD would accumulate in the lower watershed, providing additional cover habitat for juveniles.

Restoration Alternative 3: Negligible. Rearing habitat would be increased, but as the small lagoons fill in over time, it would become less than that available at Year 5 and would not be substantially different from existing conditions. Thus,

the lagoons would no longer likely include a significant increase in pool habitat. Additional LWD would accumulate in the lower watershed, providing cover habitat for juveniles.

Restoration Alternative 4: Moderate Beneficial. Rearing habitat would be increased, but would remain less than that available at Year 5 due to filling of the lagoon over time. The lagoon would still represent a substantial increase in viable rearing habitat and would be cooled by mainstream flow. Additional LWD would accumulate in the lower watershed, providing cover habitat for juveniles.

Impact FISH-R11: Effects on Juvenile Winter-Spring Salmonid– Rearing Habitat Immediately Following Construction (Short-Term, Year 0)

To survive during the winter, juvenile coho need to find shelter to avoid being swept downstream in the high currents from winter storm flows. Coho escape to slow-flowing backwater areas, side-channels, floodplains, and wetlands (commonly greater than or equal to 45 cm in depth) (McMahon 1983). The areal extent of these habitats can increase the productivity and survival of coho and steelhead. The availability of winter storm flow refuge habitat following construction will impact post-project survival of juvenile coho and steelhead.

Restoration Alternative 1: Minor Adverse. Rearing habitat would be available in deep pools as currently exist over the near term. Periodic maintenance dredging could result in a reduction in or loss of these habitat features, including deep pools and other forms of shelter. However, these effects are anticipated to be short-term, as these features would quickly reestablish through sediment deposition patterns and LWD recruitment, and effects would be limited to a small portion of the overall project site. Dredging activities will also require the relocation of coho and steelhead that are rearing in the dredging area. Relocation of coho and steelhead can result in crowding, increased competition, reduced feeding opportunities and can lead to an overall reduction of fitness and growth of rearing juvenile coho and steelhead.

Restoration Alternative 2, 3, 4: Minor Beneficial. The interim flood reduction actions could result in a short-term loss of winter rearing habitat and direct impacts to relocated fish as described for the periodic maintenance dredging activities under Restoration Alternative 1. Long-term impacts would be avoided since the restoration actions would occur within several years following the interim actions.

Under the restoration actions, newly accessible and created habitat would provide additional areal extent and increased refuge from storm flows under all alternatives, providing improved winter rearing habitat potential over the existing channel morphology. Alternatives 3 and 4 provide greater benefits through the creation of additional refugia (i.e., the lagoons). Thus, the quality of baseflow habitat availability would increase in quality and extent, with the retention of remnant channels created during restoration and the creation of off-channel

habitats and lagoon habitats. Analysis of peak flows under each alternative shows that the frequency of out-of-bank flows that allow access to the floodplain would increase under all alternatives (Philip Williams & Associates 2006—see discussion below).

However, the duration of out-of-bank flows could decrease under Alternative 2 as compared to the existing condition. This is, to some degree, an artifact of the fact that the existing channel levees trap out-of-bank flows and undersized culverts prevent flows from rejoining the main channel. Additionally the flows can become trapped behind the culverts when blocked and can result in mortality of juveniles trapped on the floodplain. Alternative 2 allows for flows to rejoin the main channel downstream of the proposed berms in a shorter period of time, but without the threat of entrapment on the floodplain. Alternatives 3 and 4 retain flows for a duration equal to that of the existing condition through utilization of lagoon features with smaller outlets, but still allow for free movement of juveniles back into the main channel of Redwood Creek (Philip Williams & Associates 2006).

Increased access to the floodplain not only provides flow refuge for juvenile salmonids, but can also provide increased feeding opportunities. Increased access to the floodplain has been shown to increase the growth rate and size of juvenile Chinook by giving juveniles access to terrestrial insects residing in the floodplain (Moyle pers. comm., Sommer et al. 2001, Sommer et al. 2005). The terrestrial insects become entrapped in flood flows and become easy prey for juveniles. Past invertebrate data show that overall insect and crustacean abundance is much greater in the adjacent off-channel, Green Gulch wetland compared to the mainstem Redwood Creek (Philip Williams & Associates 1994).

Under Alternatives 2, 3, and 4 out-of-bank flows will be reduced upstream of Pacific Way as a secondary effect of increased channel conveyance and ~~the~~ commensurate with the reduction in flooding of nearby structures. Estimated changes in channel conveyance, based on modeled flows, are summarized as follows (Philip Williams & Associates 2006):

Table 4.3.2.3-2. Estimated Changes in Channel Conveyance

	Estimated Conveyance (cfs)	
	Upstream of Pacific Way	**Downstream of Pacific Way (to parking lot/levee road)**
Existing Conditions	270	340
Design Conditions	560	300

As shown on this table, downstream of Pacific Way, designed channel capacity would be reduced somewhat (from an estimated 340 cfs under existing conditions to approximately 300 cfs under design conditions), resulting in somewhat more frequent floodplain inundation. Data from Water Years 1998–2006 (excluding 2004 and 2006, which had incomplete data) indicate that flows

as measured at the Hwy 1 bridge exceed 300 cfs on average approximately 7 times per year, although the actual number is highly variable from year to year.

Remnant channels upstream of Pacific Way that will connect to the main channel under baseflow conditions will be retained after restoration of the channel, which will to some degree compensate for this loss, but overall out-of-bank flows will be reduced in this reach. However, the floodplain habitat upstream of Pacific Way (primarily riparian) is considered of lower quality than that in the pasture downstream of Pacific Way, and the increase in out-of-bank areas downstream of Pacific Way are anticipated to more than compensate for any losses upstream.

Grading of the existing parking lot and picnic areas may allow for increased winter floodplain habitat through inundation by overbank flows from slightly upstream areas and adjacent channels. Therefore, up to an additional 2.1 acres of "potential" connected floodplain habitat is shown in Figure 6-2, although the exact area would be determined during the project design phase. Because a grading design for this area has not been developed or included in the hydraulic analysis or earthwork estimates of the preferred alternative, this area is considered "potential connected floodplain" and the high end of a range of the total inundated area.

It should be noted that the extent of floodplain inundation for a 2-year storm event (800 cfs) is approximately the same for the proposed and existing conditions. Almost the entire project area is expected to be inundated during a 2-year event except for topographic high areas, including portions of Pacific Way, the parking lot, and the bluffs on either side of the beach.

In order to ensure that there is an overall increase in the areal extent of available winter rearing habitat, NPS will enact mitigation measure FISH-MM-2. Although not necessary to mitigate for impacts to habitat, mitigation measure FISH-MM-2 has been included to ensure that the project meets strict habitat improvement goals that NPS considers integral to the success of the project.

Impact FISH-R12: Effects on Juvenile Winter-Spring Salmonid–Rearing Habitat During Early Phases of Ecosystem Establishment (Short-Term, Year 5)

Impact mechanisms would be similar to those described under Impact FISH-R11.

Restoration Alternative 1: Minor Adverse. Winter rearing habitat would not be altered and would exist in deep pools and cover as currently exists. Some LWD could accumulate in the lower watershed but could be lost in conjunction with necessary channel dredging activities. Indirect effects of necessary maintenance dredging could also include reduced growth and fitness of coho and steelhead relocated during dredging activities.

Restoration Alternative 2: Minor Beneficial. Winter rearing habitat would be increased as a result of the remnant side channels, which would be significant in providing off-channel refuge from winter flows. Floodplain adjacent to a

backwater downstream of Pacific Way would also be excavated to a slightly lower grade to expand available floodplain habitat adjacent to open backwaters. Additional rearing habitat and access to invertebrate prey would increase as the result of increased frequency of out-of-bank flows. The duration of out-of-bank flows would decrease under this alternative (Philip Williams & Associates 2006), but would not result in the entrapment of juveniles on the floodplain. Additional LWD would be placed and would accumulate in the lower watershed, providing added flow refuge for juveniles.

Grading of the existing parking lot and picnic areas may allow for increased winter floodplain habitat through inundation by overbank flows from slightly upstream areas and adjacent channels. Therefore, up to an additional 2.1 acres of "potential" connected floodplain habitat is shown in Figure 6-2, although the exact area would be determined during the project design phase. Because a grading design for this area has not been developed or included in the hydraulic analysis or earthwork estimates of the preferred alternative, this area is considered "potential connected floodplain" and the high end of a range of the total inundated area.

It should be noted that the extent of floodplain inundation for a 2-year storm event (800 cfs) is approximately the same for the proposed and existing conditions. Almost the entire project area is expected to be inundated during a 2-year event except for topographic high areas, including portions of Pacific Way, the parking lot, and the bluffs on either side of the beach.

In order to ensure that there is an overall increase in the areal extent of available winter rearing habitat, NPS will implement mitigation measure FISH-MM-2 to ensure that the areal extent of winter rearing habitat is not reduced. Although not necessary to mitigate for impacts to habitat, mitigation measure FISH-MM-2 has been included to ensure that the project meets strict rearing habitat improvement goals that NPS considers integral to the success of the project.

Restoration Alternative 3: Moderate Beneficial. Winter rearing habitat would be increased by the small lagoons, with both new lagoons providing additional off-channel refuge from winter flows. The placement of the lagoons off the main flow would result in substantial increases in flow refuge for overwintering juvenile coho and steelhead. Additional rearing habitat and access to invertebrate prey would increase as the result of increased frequency of out-of-bank flows. Additional LWD would be placed, providing increased flow refuge for juveniles.

In order to ensure that there is an overall increase in the areal extent of available winter rearing habitat, NPS will implement mitigation measure FISH-MM-2 to ensure that the areal extent of winter rearing habitat is not reduced. While not necessary to mitigate for impacts to habitat, mitigation measure FISH-MM-2 has been included in order to ensure that the project meets strict rearing habitat improvement goals that NPS considers integral to the success of the project.

Restoration Alternative 4: Moderate Beneficial. Winter rearing habitat would be increased appreciably with the new mainstem lagoon providing refuge from

winter flows in the lagoon margins. Additional rearing habitat and access to invertebrate prey would increase as the result of increased frequency of out-of-bank flows. Additional LWD would be placed and would accumulate in the lower watershed, providing increased flow refuge for juveniles.

In order to ensure that there is an overall increase in the areal extent of available winter rearing habitat, NPS will implement mitigation measure FISH-MM-2 to ensure that the areal extent of winter rearing habitat is not reduced. Although not necessary to mitigate for impacts to habitat, mitigation measure FISH-MM-2 has been included to ensure that the project meets strict rearing habitat improvement goals that NPS considers integral to the success of the project.

Impact FISH-R13: Effects on Juvenile Winter Salmonid–Rearing Habitat During Later Phases of Ecosystem Establishment (Long-Term, Year 50)

Impact mechanisms would be similar to those described under Impact FISH-R11.

Restoration Alternative 1: Minor Adverse. Winter rearing habitat would not be altered and would exist in deep pools and cover as currently exists. Some LWD could accumulate in the lower watershed but could be lost in conjunction with necessary channel dredging activities. Indirect effects of necessary maintenance dredging could also include reduced growth and fitness of coho and steelhead relocated during dredging activities.

Restoration Alternative 2: Minor Beneficial. Winter rearing habitat would have a tendency to return to existing conditions over time, as the remnant side channels fill with sediment and become isolated from the active channel. It is possible that channel migration over time could result in the formation of new side channels or oxbows that would provide additional refugia. Additional rearing habitat and access to invertebrate prey would increase as the result of increased frequency of out-of-bank flows and could increase even more over the course of the project as the channel fills, thus increasing potential access to the floodplain. The duration of out-of-bank flows would decrease under this alternative, but would not result in the entrapment of juveniles on the floodplain. Additional LWD would accumulate in the lower watershed, providing added flow refuge for juveniles.

Grading of the existing parking lot and picnic areas may allow for increased winter floodplain habitat through inundation by overbank flows from slightly upstream areas and adjacent channels. Therefore, up to an additional 2.1 acres of “potential” connected floodplain habitat is shown in Figure 6-2, although the exact area would be determined during the project design phase. Because a grading design for this area has not been developed or included in the hydraulic analysis or earthwork estimates of the preferred alternative, this area is considered “potential connected floodplain” and the high end of a range of the total inundated area.

In order to ensure that there is an overall increase in the areal extent of available winter rearing habitat, NPS will implement mitigation measure FISH-MM-2 to ensure that the areal extent of winter rearing habitat is not reduced. Although not necessary to mitigate for impacts to habitat, mitigation measure FISH-MM-2 has been included to ensure that the project meets strict rearing habitat improvement goals that NPS considers integral to the success of the project.

Restoration Alternative 3: Minor Beneficial. Winter rearing habitat would be increased, but as the small lagoons fill in over time, it would become less than that available at Year 5 and would not be substantially different from existing conditions. However, the remaining extent of the lagoons located off the main flow would result in appreciable increases in flow refuge for overwintering juvenile coho and steelhead. Additional rearing habitat and access to invertebrate prey would increase as the result of increased frequency of out-of-bank flows and could increase even more over the course of the project as the channel and lagoon fill, thus increasing potential access to the floodplain. Additional LWD would accumulate over time, providing increased flow refuge for juveniles.

In order to ensure that there is an overall increase in the areal extent of available winter rearing habitat, NPS will implement mitigation measure FISH-MM-2 to ensure that the areal extent of winter rearing habitat is not reduced. Although not necessary to mitigate for impacts to habitat, mitigation measure FISH-MM-2 has been included to ensure that the project meets strict rearing habitat improvement goals that NPS considers integral to the success of the project.

Restoration Alternative 4: Minor Beneficial. Winter rearing habitat would be increased, but would remain less than that available at Year 5 due to filling of the lagoon over time. The mainstem lagoon would still provide refuge from winter flows in the lagoon margins. Additional rearing habitat and access to invertebrate prey would increase as the result of increased frequency of out-of-bank flows and could increase even more over the course of the project as the channel and lagoons fill with sediment, thus increasing potential access to the floodplain. Additional LWD would accumulate in the lower watershed, providing increased flow refuge for juveniles.

In order to ensure that there is an overall increase in the areal extent of available winter rearing habitat, NPS will implement mitigation measure FISH-MM-2 to ensure that the areal extent of winter rearing habitat is not reduced. Although not necessary to mitigate for impacts to habitat, mitigation measure FISH-MM-2 has been included to ensure that the project meets strict rearing habitat improvement goals that NPS considers integral to the success of the project.

Public Access Alternatives

The Public Access Alternatives, as described in Chapter 2, are in areas that have no fish resources. Construction-related effects related to ground disturbance and potential release of hazardous materials are similar among all action alternatives

and are as described under Impacts FISH-R1 and FISH-R2. The impacts of the Public Access Alternatives to fish are not discussed further.

Bridge Alternatives

Table 4.3.2.3-3 summarizes the potential impacts of Bridge Alternatives to fisheries in the study area. Construction-related effects related to ground disturbance and potential release of hazardous materials are similar among all action alternatives and are as described under Impacts FISH-R1 and FISH-R2. The Bridge Alternatives are described in Chapter 2.

Table 4.3.2.3-3. Potential Fisheries Impacts from Bridge Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	Mitigation Measure
FISH-B1: Fish Passage Impediments Due to Flow Alterations Resulting from Pacific Way Bridge During the Project's Lifetime	Negligible	Minor Adverse	Minor Adverse	Minor Beneficial	Minor Beneficial	
FISH-B2: Direct or Indirect Mortality and Increased Stress to Fish Due to Pile Driving and Increased Sound Pressure Levels	Negligible	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	FISH-MM-3: Avoidance and Monitoring of Fish Sound Pressure Levels during Pile Driving Activities

Impact FISH-B1: Fish Passage Impediments Due to Flow Alterations Resulting from Pacific Way Bridge During the Project's Lifetime (Long-Term, Years 5 and 50)

Minimum passage requirements for adult coho and steelhead are usually set at a minimum passage depth of 0.8 feet, with a water velocity not exceeding 6 fps over a distance no greater than 60 feet (California Department of Fish and Game 2003, Washington Department of Fish and Wildlife 2003). When these metrics are exceeded, coho and steelhead do not have the metabolic energy to overcome the barrier and, if they do, do so at a significant cost to the fitness and reproductive success of the individual. While all action alternatives would allow

for a channel of sufficient depth to allow for fish passage, potential flood flows at the new bridge would be confined and velocities could exceed passage thresholds. This is compared to the existing conditions where high flows proceed unimpeded through the low point of the valley. Additionally, under some alternatives flows can overtop the bridge or roadway approaches, creating localized problems for passage around the bridge. These effects would be reduced under the larger bridge spans, which would result in less concentration of flows and more infrequent overtopping during large events.

Restoration Alternative BR0: Negligible. No changes to the Pacific Way Bridge would occur that would change fish passage conditions.

Bridge Alternative BR1: Minor Adverse. The narrow span of this bridge and the increased flow impediment of the raised roadway would raise flood elevations upstream compared to existing conditions, resulting in what is anticipated to be an increased velocity through the bridge opening. This could result in some adverse effects related to fish migration during larger flow events.

Bridge Alternative BR2: Minor Adverse. The flow impediments of the narrow bridge span would be offset by the low roadway approaches, resulting is similar flood elevations upstream as under current conditions. For this reason, flow velocities are anticipated to be similar to existing conditions. However, the overtopping of the low roadway approaches could cause fish passage impediments or conditions of insufficient depth during larger storm events.

Bridge Alternatives BR3 and BR4: Minor Beneficial. Under these alternatives, the vast majority of storm returns are conveyed below the bridge structure, and the bridges, due to their wider span, are not anticipated to serve as impediments that increase velocity potential in excess of the existing condition. The additional width of the floodplain is anticipated to allow for flood flows to spread out from the channel in a more natural manner, providing low flow refuge in the flood margins.

Impact FISH-B2: Direct or Indirect Mortality and Increased Stress to Fish Due to Pile Driving and Increased Sound Pressure Levels (Short-Term)

All Alternatives: Moderate Adverse. The construction of the Pacific Way Bridge may require pile driving, but the need for pile driving cannot be fully determined until a subsurface geotechnical investigation is conducted during the design process for the bridge. While ground-borne vibration quickly attenuates (Federal Transit Administration 1995) and further attenuation will occur at the ground/water interface, sound pressure impacts to fish in nearby water bodies cannot be completely ruled out. High sound pressure levels (SPL) in excess of 180 dB could physically injure and kill juvenile and adult fish due to injuries from the percussive shock of these activities. Additionally, incubating salmonid embryos are immobile and sensitive to percussion-related energy shock waves. . If engineers determine that pile driving is necessary for structural soundness and

that sound pressure within Redwood Creek could reach 180 dB, NPS will implement Mitigation Measure FISH-MM-3 to reduce or avoid impacts on fish in the nearby creek.

Fill Disposal Alternatives

The Fill Disposal Alternatives are locations where fill would be stable and would not impact existing floodplains, riparian areas, or active drainages. They are not anticipated to have effects on fisheries or fish habitat. The haul route to the Upper Banducci site would have a temporary impact on an intermittent drainage during the dry season, because the drainage would have to be filled temporarily to allow safe truck passage onto the field. However, because the drainage would be dry at the time of hauling and would be restored to natural contours prior to the onset of rains, there would be no impact to fish or fish habitat.

Mitigation Measures

Mitigation Measure FISH-MM-1: Riparian Shade Mitigation and Monitoring.

Water temperatures will be monitored at the site through Year 5, post-construction, to ensure that they remain within the range of acceptable conditions for fish. Should temperatures be found to be outside the acceptable range for fish, NPS may use temporary, artificial means of shading during summer months while riparian vegetation matures. For example, long willow stakes may be tied together to create “rafts” that float on the water surface, thus creating shade and cool pockets of water. The rafts will appear natural and wash downstream on their own, and no on-site management of artificial materials will be needed. Additionally, ~~R~~riparian shade transects will be established to monitor and assess the recovery of riparian vegetation and the shade they provide.

Mitigation Measure FISH-MM-2: Optimization of Winter Rearing Habitat.

Regardless of which alternative is selected, during the process of design, NPS will ensure that potential winter rearing habitat created by the project provides a net increase in the areal extent of habitat.

Mitigation Measure FISH-MM-3: Avoidance and Monitoring of High Sound Pressure Levels during Pile-Driving Activities.

All permanent pile-driving activities will be conducted between July 15 and October 15 to avoid the peak migration of adult and juvenile coho salmon. All reasonable measures, including the use of vibratory hammers, dewatering, etc., will be incorporated to ensure that peak underwater SPLs in Redwood Creek remain below 180 dB at a distance of 10 meters from the pile; all temporary and permanent pile-driving activities will be monitored by a qualified fish biologist during the entire project.

4.3.3 Cultural Resources

4.3.3.1 Guiding Regulations and Policies

GGNRA conducts cultural resources studies in compliance with Section 106 of the National Historic Preservation Act (NHPA) and other associated mandates conducted in consultation with the Division of the Cultural Resources and Museum Management. Early in the planning process, to ensure that historic properties are not adversely affected by NPS projects, the Golden Gate National Recreation Area historic preservation committee (5X Committee) reviews proposed work and establishes requirements for cultural resource protection. All park undertakings with potential to affect cultural resources are reviewed through this process.

The Big Lagoon creek and wetland restoration project was first brought to the 5X Committee in 2002 for preliminary consideration. The project is being reviewed in accordance with the 1995 Nationwide Programmatic Agreement between NPS, the Advisory Council on Historic Preservation, and the National Council of Historic Preservation Officers (http://www.achp.gov/npspa1.html), and the 1992 Programmatic Agreement between SHPO and the Advisory Council on Historic Preservation that is specific to GGNRA. This agreement allows project planning and implementation to proceed with internal park management as long as no historic property eligible for listing in the National Register of Historic Places (NRHP) would be adversely affected by project actions. If adverse effects are expected, then NPS would need to fully consult with SHPO in accordance with regulations set forth in 36 CFR 800 (Protection of Historic and Cultural Properties).

During the course of planning for the Big Lagoon project and the cultural resources surveys currently completed as well as for future cultural resources investigations for the project, the following federal mandates have been and will be used to review project elements.

- National Historic Preservation Act of 1966.
- Archaeological Resources Protection Act of 1979.
- Native American Graves Protection and Repatriation Act of 1990.
- National Environmental Policy Act of 1969.
- American Indian Religious Freedom Act of 1978.
- Executive Order 13007 (Indian Sacred Sites).
- Presidential Memorandum on Government to Government Relations with Native American Tribal Governments (April 29, 1995).
- NPS Director's Order 12C (Park Planning).
- NPS Director's Order 28 (Cultural Resources Management).

- NPS Director's Order 28A (Archaeology).
- Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation.
- The NPS Organic Act.
- ~~Executive Order 13007.~~
- Big Lagoon Wetland and Creek Restoration: Project Goals.

In 2003, NPS initiated formal consultation with the Federated Indians of the Graton Rancheria (FIGR), and tribal representatives have participated in the development of technical studies and project alternatives. Tribal representatives will also continue to be involved in all aspects of archaeological field and laboratory work associated with indigenous sites.

4.3.3.2 Study Area

The project is located within the boundaries of the GGNRA, the ~~Green Gulch~~San Francisco Zen Center (Green Dragon Temple [Soryu-ji]), and the private lands of the Muir Beach residents and community (Barker 2005). The APEs on cultural resources for the Big Lagoon project included two different boundaries. One APE boundary addresses the potential direct impacts of the various project alternatives, and consists of the project site boundaries. The other APE encompasses a larger area to include all the full historic ranch boundaries and address potential indirect impacts (e.g., changed viewsheds; introducing new elements into an historic setting). Compliance with the NHPA often entails the inclusion of full parcels in an APE even though only one part of the parcel may be affected by the proposed project (Barker 2005).

4.3.3.3 Analysis Thresholds

For the purposes of assessing effects on historic properties under the NHPA, effects are either adverse or not adverse. Effects under both NEPA and NHPA are considered adverse when they diminish the significant characteristics of a historic property. Because the intensity of impact is different for different types of cultural resources, thresholds and intensity of impacts for the specific types of resources (archaeological sites, historic buildings and structures, ethnographic resources, and cultural landscapes) are described separately below.

Archaeological Resources

Certain important research questions about human history can only be answered by the actual physical material of cultural resources. Archaeological resources have the potential to answer, in whole or in part, such research questions as well as provide material evidence for past lifeways and environs of precontact

populations. In addition, these resources provide value based on their importance to associated native peoples. According to the National Register of Historic Places, a site or material remains can be evaluated according to the following criteria:

- They are associated with events that have made a significant contribution to the broad patterns of our history;
- They are associated with the lives of persons significant in our past;
- They embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- They have yielded, or may be likely to yield, information important in prehistory or history.

An archaeological site, or a set of related archaeological sites, can be nominated to the NRHP in one of three historic contexts or levels of significance: local, state, or national (see *National Register Bulletin, Guidelines for Evaluating and Registering Archeological Properties*, <http://www.cr.nps.gov/nr/publications/bulletins/arch/>). For purposes of analyzing impacts on archaeological resources, the level of impact of a proposed action is related to the potential of the site to yield information important in prehistory or history, as well as the probable historic context of the affected site.

- **Negligible*:*** The impact is at the lowest level of detection or barely measurable, with no perceptible consequences, either adverse or beneficial, to archaeological resources. For purposes of Section 106, the determination of effect would be "no adverse effect."
- **Minor*:***
  - Adverse—The impact would affect an archaeological site with the potential to yield information important in prehistory or history, but would not affect portions of the property that had integrity or elements that were pivotal to the site's significance. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."
  - Beneficial—The site would be preserved in its natural state. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."
- **Moderate:**
  - Adverse—The impact would affect an archaeological site with the potential to yield information important in prehistory or history, and would impact portions of the property that had integrity or elements that were pivotal to the site's significance. For purposes of NHPA Section 106, the determination of effect would be "adverse effect."

- Beneficial—The site would be stabilized in order to prevent future impacts to archaeological resources. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."

- **Major:**
  - Adverse—The impact would affect an archaeological site with the potential to yield important information about human history or prehistory, and would remove sufficient amounts of the resource to the extent that it would no longer have integrity or elements considered significant. For purposes of NHPA Section 106, the determination of effect would be "adverse effect."
  - Beneficial—Active intervention would be taken to preserve the archaeological resources at the site. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."

Ethnographic Resources

Ethnographic resources have the potential to answer questions about contemporary peoples or groups, their identity, and heritage. As defined by NPS, an ethnographic resource is a site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it.

Some places of traditional cultural use may be eligible for inclusion in the NRHP as traditional cultural properties (TCPs) because of their association with cultural practices or beliefs of a living community that (1) are rooted in that community's history and (2) are important in maintaining the continuing cultural identity of the community (see *National Register Bulletin, Guidelines for Evaluating and Documenting Traditional Cultural Properties*, <http://www.cr.nps.gov/nr/publications/bulletins/nrb38/>). For purposes of analyzing potential impacts on ethnographic resources, the thresholds of change for the intensity of an impact are defined below.

- **Negligible:** The impact would be at the lowest levels of detection or barely measurable, with no perceptible consequences, either adverse or beneficial, on ethnographic resources, and would neither alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of beliefs and practices. For purposes of Section 106, the determination of effect would be no adverse effect.

- **Minor:**
  - Adverse—The disturbance to the site would be confined to a small area with little, if any, loss of important information potential. The impact would be slight but noticeable and would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of

beliefs. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."

- Beneficial—The site would be preserved in its natural state. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."

- **Moderate:**
  - Adverse—Disturbance of a site would result in a loss of important information through altered resource conditions, and would impair traditional access or site preservation, and/or the relationship between the resource and the affiliated group's body of beliefs. For purposes of NHPA Section 106, the determination of effect would be "adverse effect."
  - Beneficial—There would be passive intervention to preserve ethnographic resources at the site from further degradation (e.g., protective fencing, stabilization). For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."
- **Major:**
  - Adverse—Disturbance of a site would be substantial and would result in the loss of most or all of the site and its potential to yield important information. Traditional access and/or the relationship between the resource and the affiliated group's body of beliefs would be substantially impaired. For purposes of NHPA Section 106, the determination of effect would be "adverse effect."
  - Beneficial—There would be active intervention to preserve the ethnographic resources at the site. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."

Historic Structures and Buildings

For a structure or building to be listed on the NRHP, it must be associated with an important historic context. That is, it must possess significance—the meaning or value ascribed to the structure or building—*and* have integrity of those features necessary to convey its significance (e.g., location, design, setting, workmanship, materials, feeling, and association; see *National Register Bulletin #15, How to Apply the National Register Criteria for Evaluation*, http://www.cr.nps.gov/nr/publications/bulletins/nrb15/). For purposes of analyzing potential impacts on historic structures/buildings, the thresholds of change for the intensity of an impact are defined as follows.

- **Negligible:** The impact would cause no alteration to any structures or buildings listed or eligible for listing on the NRHP, or any alterations would be at the lowest level of detection or barely perceptible and not measurable. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."

- **Minor:**
  - Adverse—The impact would not affect the character-defining features of a structure or building listed on or eligible for the NRHP. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."
  - Beneficial—The character-defining features of one or more structures or buildings listed on or eligible for the NRHP would be stabilized or preserved in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (36 CFR 68.1)**,** to maintain existing historic integrity. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect**."**

- **Moderate:**
  - Adverse—The impact would alter a character-defining feature(s) of one or more structures or buildings listed on or eligible for the NRHP, but would not diminish the integrity of the resource to the extent that its national register eligibility would be jeopardized. For purposes of NHPA Section 106, the determination of effect would be either "adverse effect" or "no adverse effect."
  - Beneficial—One or more NHRP listed or eligible structures or buildings would be rehabilitated in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."

- **Major:**
  - Adverse—The impact would alter a character-defining feature(s) of one or more structures or buildings listed on or eligible for the NRHP, diminishing the integrity of the resource to the extent that it is no longer eligible to be listed on the NRHP. For purposes of NHPA Section 106, the determination of effect would be "adverse effect."
  - Beneficial—One or more NHRP listed or eligible structures or buildings would be restored in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties to accurately depict its form, features, and character as it appeared during its period of significance. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect**."**

Cultural Landscapes

Cultural landscapes are the result of the long interaction between people and the natural landscape. Shaped through time by historic and precontact land-use and management practices, as well as culture, politics and property laws, levels of technology, and economic conditions, cultural landscapes provide a living record of an area's past—a visual chronicle of its history. Modern human life, however,

contributes to the continual reshaping of cultural landscapes, making them a good source of information about specific times and places, while at the same time rendering their long-term preservation a challenge.

For a cultural landscape to be listed on the NRHP, it must possess significance—the meaning or value ascribed to the landscape and its components—*and* have integrity of those features necessary to convey its significance. The character-defining features of a cultural landscape include spatial organization and land patterns; topography; vegetation; circulation patterns; water features; and structures/buildings, site furnishings, and objects (see *The Secretary of the Interior's Standards for the Treatment of Historic Properties and the Guidelines for the Treatment of Cultural Landscapes*, 1996, http://www.cr.nps.gov/hps/hli/introguid.htm). For purposes of analyzing potential impacts on cultural landscapes, the thresholds of change for the intensity of an impact are defined as follows.

- **Negligible:** The impact would cause no alteration to a cultural landscape listed or eligible for listing on the NRHP, or any alterations would be at the lowest levels of detection or barely perceptible and not measurable. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."
- **Minor:**
  - Adverse—The impact would not affect the character-defining features of a cultural landscape listed on or eligible for the NRHP. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."
  - Beneficial—Character-defining features would be preserved in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes, therefore maintaining the integrity of the cultural landscape. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."
- **Moderate:**
  - Adverse—The impact would alter one or more character-defining features of a cultural landscape listed or eligible for listing on the NRHP but would not diminish the integrity of the landscape to the extent that its NRHP eligibility would be jeopardized. For purposes of NHPA Section 106, the determination of effect would be either "adverse effect" or "no adverse effect."
  - Beneficial—The landscape or its features would be rehabilitated in accordance with the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."

- **Major:**
  - Adverse—The impact would alter one or more character-defining feature(s) of a cultural landscape listed or eligible for the NRHP, diminishing the integrity of the resource to the extent that it would no longer be eligible to be listed on the NRHP. For purposes of NHPA Section 106, the determination of effect would be "adverse effect**."**
  - Beneficial—The cultural landscape would be restored in accordance with the Secretary of the Interior's Standards to accurately depict the features and character of a landscape as it appeared during its period of significance. For purposes of NHPA Section 106, the determination of effect would be "no adverse effect."

Impairment

The proposed actions have been evaluated for their potential to impair cultural resources. Impairment in this context is defined as a major, adverse impact on a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of GGNRA; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in NPS's general management plan or other relevant NPS planning documents.

4.3.3.4 Methods and Assumptions

This impact analysis methodology includes the consideration of four categories of cultural resources within the APE, all of which are considered historic properties for the purposes of Section 106 of NHPA and NEPA regulations: archaeological resources, ethnographic resources, historic buildings and structures, and cultural landscapes. The following primary steps were taken in assessing impacts on cultural resources.

- NPS goals and objectives regarding the existing cultural resources in the project area (see below) were reviewed.
- All previously conducted cultural resources studies for the project in relationship to the project alternatives were reviewed, including the following studies:
  - Big Lagoon Wetland and Creek Restoration Project: Cultural Resources Survey, Muir Beach, Marin County, California (Barker 2005).
  - Preliminary Geoarchaeological Assessment of the "Big Lagoon" and Banducci Ranch Restoration Projects, Lower Redwood Creek, Marin County, California (Meyer 2002).
  - Geoarchaeological Study of Big Lagoon, Lower Redwood Creek, Marin County, California (Meyer 2005)

- An Overview of Geoarchaeological Issues. In, Archaeological Research Issues for the Point Reyes National Seashore and Golden Gate National Recreation Area, edited by Suzanne Stewart and Adrian Praetzellis (Meyer 2003).
- Environmental Impact Methodologies and Thresholds Examples (Environmental Quality Division 2004).
- Recent studies of NRHP eligibility for several Marin Headlands ranches, including the Golden Gate Dairy and Banducci Flower Farm.
- Revised Preliminary Report of the Archaeological Evaluation of CA-MRN-674 (P-21-2615), near Redwood Creek, Muir Beach, California (Psota 2006).
- National Register of Historic Places, Nomination Form for the Muir Beach Archaeological Site (CA-MRN-333) (Kelly 1979)
- California Department of Transportation Negative Archaeological Survey Report, Big Lagoon. (Hayes 1996)

- Analysis of the potential of the actions of all proposed project alternatives to affect the significant cultural resources within the project area.
- Assessment of the level of intensity of the impacts on the cultural resources and the thresholds of significance for cultural resources within the APE.

Note that many of the sites discussed in this report are under different ownership and may be subject to different procedures for protection. These differences are discussed where relevant.

Specific Project Goals Set Forth by NPS

In June 2002, the following key goals were established for the Big Lagoon project.

- Obtain sufficient information to develop conceptual plans of project alternatives that will have no adverse effect on precontact/indigenous sites in the APE.
- Work in conjunction with the Federated Indians of Graton Rancheria to incorporate the traditional values of the tribe and to protect indigenous archaeological sites within the APE.
- Work mutually with the Federated Indians of Graton Rancheria tribe in the conceptual planning and any later implementation process.
- Recognize the precontact/indigenous sites as a part of the ecological restoration. Incorporate native sites and traditional values into the restoration plans.

The opportunity to broaden the definition of cultural heritage from the routine preservation of historic properties to the possible design of a wetland and creek restoration with traditional plant or land uses in mind is a particularly important subject of research and consultation between tribe and park, natural, and cultural resource specialists.

4.3.3.5 Restoration Alternatives

Table 4.3.3-1 summarizes the potential impacts of Restoration Alternatives to cultural resources. The Restoration Alternatives are described in Chapter 2.

Table 4.3.3-1. Potential Cultural Resources Impacts from Restoration Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				
Impact	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	Mitigation Measure
CR-R1: Disturbance to Archaeological Site CA-MRN-333	Negligible	Negligible	Negligible	Negligible	CR-MM-1: Cultural Resources Education, Archaeological Monitoring, and Discovery Measures.
CR-R2: Disturbance to the "Fan Site"	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	CR-MM-1 CR-MM-2: Educate the Workers Conducting the Harding Grass Removal and Have an Archaeological Monitor in the Vicinity of the Fan Site.
CR-R3: Disturbance to CA-MRN-674	Negligible	Negligible	Negligible	Negligible	CR-MM-1
CR-R4: Disturbance to the Golden Gate Dairy	Negligible	Negligible	Negligible	Negligible	
CR-R5: Disturbance to Previously Unidentified Cultural Resources During Construction	Negligible	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	CR-MM-1 CR-MM-2
CR-R6: Disturbance to Previously Identified or Unidentified Cultural Resources During Site Evolution	Negligible	Negligible	Negligible	Negligible	

Impact CR-R1: Disturbance to Archaeological Site CA-MRN-333 (Long-Term, Year 0)

The removal of the remaining tavern features, particularly related to the tavern structure itself, and/or excavation activities associated with tidal lagoon expansion or kikuyu grass removal, could affect midden deposits associated with archaeological site CA-MRN-333. However, only tavern features located outside the recorded archaeological site boundaries would be removed. In addition, the removal of rubble and fill adjacent to the parking lot and other excavation activities would also occur adjacent to (outside of) recorded site boundaries, and the site would be avoided.

Restoration Alternative 1: Negligible. This site would remain in place as currently managed by NPS.

Restoration Alternatives 2, 3, 4: Negligible. There will be restoration activities in the vicinity and adjacent to this site associated with the removal of the remaining tavern features. However, as discussed above, activities would avoid this site. Because the potential for restoration activities to uncover previously undiscovered aspects of this site is considered low, the potential for impacts is considered negligible, and such discoveries would be addressed through mitigation measure CR-MM-1.

Impact CR-R2: Disturbance to the “Fan Site” (Long-term, Year 0)

Restoration Alternative 1: Negligible. No actions would be taken that would alter the continued buried state of this resource or affect accumulation of additional alluvial deposits over the existing site.

Restoration Alternatives 2, 3, and 4: Minor Adverse. All action alternatives would support recovery of native plants by removing invasive non-native plant species, including Harding grass, which is located at various locations on the project site, including the Fan Site. Since the archaeological deposit associated with the Fan Site is close to the existing ground surface, there is the potential that the Harding grass removal activities could disturb the site. Implementation of mitigation measure CR-MM-1 and CR-MM-2 would reduce or eliminate the impact.

Impact CR-R3: Disturbance to CA-MRN-674 (Long-Term, Year 0)

Recent subsurface archaeological investigations into CA-MRN-674 (Psota 2006) indicate that there is an NRHP eligible archaeological site located from 3.6–4.6 feet below the existing ground surface.

Restoration Alternative 1: No action at this location would occur, resulting in the continued buried state of this resource and perhaps accumulative of additional alluvial deposits over the existing site.

Restoration Alternatives 2, 3, and 4: Negligible. The proposed restoration actions, such as realignment of the creek channel, would be located outside of the boundaries of the site. Because of the site's depth, the lowering of the groundwater at the site from the alternatives should not affect the deposit.

Because the potential for restoration activities to uncover previously undiscovered aspects of this site is considered low, the potential for impacts is considered negligible, and such discoveries would be addressed through mitigation measure CR-MM-1.

Impact CR-R4: Disturbance to the Golden Gate Dairy (Long-Term, Year 0)

The Monterey pine and concrete curb at the intersection of Hwy 1 and Pacific Way have been determined not to be components of the potentially NRHP-eligible Golden Gate Dairy complex. Therefore, while removal of these features is possible under the action alternatives as part of construction of the pedestrian path from Hwy 1 to the beach, such removal would not be considered an impact from the perspective of cultural resources. In addition, although the restoration actions would modify the appearance of the surrounding landscape, they are not anticipated to have indirect effects on the Golden Gate Dairy such that they would compromise its integrity.

Restoration Alternatives 1, 2, 3, 4: Negligible. No action would be taken at this location.

Impact CR-R5: Disturbance to Previously Unidentified Cultural Resources During Construction (Long-Term, Year 0)

While the project site has been extensively studied and sampled for cultural resources, it is possible that previously undiscovered potentially NHRP-eligible resources exist on the site. The site is considered to have moderate potential to contain such resources. Any action that results in compromising the integrity of such resources, including both interim flood reduction measures and the larger restoration project, would be considered to have an adverse impact.

Restoration Alternative 1: Negligible. Periodic maintenance dredging activities are not anticipated to affect previously undiscovered cultural resources.

Restoration Alternatives 2, 3, 4: Major Adverse. Under all action alternatives, construction would involve much surface disturbance and earthwork, which

could expose and/or damage previously undiscovered buried cultural resources. Any impact on such sites would be significant. Mitigation measures CR-MM-1 and CR-MM-2 would reduce this impact below significance thresholds.

Impact CR-R6: Disturbance to Previously Identified or Unidentified Cultural Resources During Site Evolution (Long-Term, Years 5 and 50)

Changes to the site over time could result in changes in the erosional pattern or other site changes that could expose and/or degrade NHRP-eligible resources.

Restoration Alternatives 1, 2, 3, 4: Negligible. While the landforms associated with all of the alternatives would help shape erosional/depositional patterns and/or the geomorphology of the site over time, the potential for such changes to affect cultural resources is considered speculative, and correspondingly are considered to be of low probability.

4.3.3.6 Public Access Alternatives

Table 4.3.3-2 summarizes the potential impacts of Public Access Alternatives to cultural resources in the study area. The Public Access Alternatives are described in Chapter 2.

Table 4.3.3-2. Potential Cultural Resources Impacts from Public Access Alternatives

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
CR-P1: Disturbance to Archaeological Site CA-MRN-333	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
CR-P2: Disturbance to the "Fan Site"	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	CR-MM-1.
CR-P3: Disturbance to CA-MRN-674	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	CR-MM-1. CR-MM-3: Limit Compaction Methods Above the Recorded Deposit; Consult with NPS, the County, and FIGR; and Clarify Site Disposition During the Design Process.
CR-P4: Disturbance to Golden Gate Dairy Complex	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
CR-P5: Disturbance to Previously Unidentified Cultural Resources During Construction	Negligible	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	CR-MM-1
CR-P6: Disturbance to Previously Identified or Unidentified Cultural Resources During Site Evolution	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	

Impact CR-P1: Disturbance to Archaeological Site CA-MRN-333 (Long-Term, Year 0)

Impact mechanisms would be similar to those described under Impact CR-R1.

Public Access Alternative A: Negligible. This NRHP-listed precontact site would remain in place as currently managed by NPS.

Public Access Alternatives B1–B5, C: Negligible. No public access actions are planned in the vicinity of this site.

Impact CR-P2: Disturbance to the "Fan Site" (Long-Term, Year 0)

Public Access Alternative A: Negligible. No action at this location would result in the continued buried state of this resource and perhaps accumulation of additional alluvial deposits over the existing site.

Public Access Alternatives B1–B5, C: Minor Adverse. Improvement of the emergency access road proposed along the southern edge of the project boundary could encroach on the buried midden deposits associated with the Fan Site, including deposits not currently identified. However, the improvements to the emergency access road in the vicinity of this site would be limited to removal (i.e., trimming) of encroaching vegetation and would not involve any earthwork or grading. Therefore, no substantial impacts are anticipated. Implementation of mitigation measure CR-MM-1 would ensure this.

Impacts as a result of removal of invasive vegetation are discussed above.

Impact CR-P3: Disturbance to CA-MRN-674 (Long-Term, Year 0)

Public Access Alternative A: Negligible. No action at this location would result in the disturbance of the continued buried state of this resource

Public Access Alternatives B1–B5, C: Minor Adverse. The alignment of the new pedestrian path from Hwy 1 to the parking lot could coincide with portions of the underlying deposits associated with CA-MRN-674. The site is already capped with fill, and construction of the trail is most likely to only add additional fill on top of it, although compaction of this fill could occur. However, according to Psota (2006) there is no indication that the placement of fill over the archaeological deposit will harm it. The report does conclude that if subsurface compaction is mechanical, then the potential for adverse effects to CA-MRN-674 is possible, but undetermined depending upon the mechanical device used during construction. Implementation of mitigation measure CR-MM-1 and CR-MM-3 would reduce or eliminate this impact.

Impact CR-P4: Disturbance to Golden Gate Dairy Complex (Long-Term, Year 0)

The Monterey pine and concrete curb at the intersection of Hwy 1 and Pacific Way have been determined not to be components of the potentially NRHP-eligible Golden Gate Dairy complex. Therefore, while removal of these features is possible under the action alternatives as part of construction of the pedestrian path from Hwy 1 to the beach, such removal would not be considered an impact from the perspective of cultural resources. In addition, the public access actions are not anticipated to have any indirect effects on the Golden Gate Dairy that could compromise its integrity.

Public Access Alternative A: Negligible. No action would be taken at this location.

Public Access Alternatives B1–B5, C: Negligible.

Impact CR-P5: Disturbance to Previously Unidentified Cultural Resources During Construction (Long-Term, Year 0)

Impact mechanisms would be as described under Impact CR-R5.

Public Access Alternative A: Negligible. No actions would be taken that could expose previously undiscovered sites.

Public Access Alternative B1–B5, C: Major Adverse. Under all action alternatives, construction would involve much surface disturbance and earthwork, which could expose and/or damage previously undiscovered buried cultural resources. Any impact on such sites would be significant. Mitigation measure CR-MM-1 would reduce this impact below significance thresholds.

Impact CR-P6: Disturbance to Previously Identified or Unidentified Cultural Resources During Site Evolution (Long-Term, Years 5 and 50)

Impact mechanisms would be the same as those described under Impact CR-R6. In addition, increased pedestrian traffic in certain portions of the project area as a result of the new trails and other features associated with the action alternatives could lead to disturbance of cultural resources.

Public Access Alternative A: Negligible. While the landforms and structures associated with the No Action alternative help shape erosional/depositional patterns and/or the geomorphology of the site over time, the potential for such changes to affect cultural resources is considered speculative, and correspondingly is considered to be of low probability. No new public access

features would be constructed that could result in increased human access to known or unknown sites.

Public Access Alternative B1–B5, C: Negligible. While the landforms and structures associated with all action alternatives help shape erosional/depositional patterns and/or the geomorphology of the site over time, the potential for such changes to affect cultural resources is considered speculative, and correspondingly is considered to be of low probability. In addition, while new public access features could result in increased human access to areas not currently accessible to pedestrians or vehicles, these features would be designed to avoid known sites, and the potential for affecting undiscovered sites as a result of new or realigned facilities is considered low.

4.3.3.7 Bridge Alternatives

Table 4.3.3-3 summarizes the potential impacts of Bridge Alternatives to cultural resources in the study area. The Bridge Alternatives are described in Chapter 2.

Table 4.3.3-3. Potential Cultural Resources Impacts from Bridge Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	Mitigation Measure
CR-B1: Disturbance to CA-MRN-674	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	CR-MM-3
CR-B2: Disturbance to Previously Unidentified Cultural Resources During Construction	Negligible	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	CR-MM-1
CR-B3: Disturbance to Previously Identified or Unidentified Cultural Resources During Site Evolution	Negligible	Negligible	Negligible	Negligible	Negligible	

Impact CR-B1: Disturbance to CA-MRN-674 (Long-Term, Year 0)

Bridge Alternative BR0: Negligible. No action at this location would result in the continued buried state of this resource and perhaps accumulation of additional alluvial deposits over the existing site.

Bridge Alternatives BR1–BR4: Minor Adverse. These Bridge Alternatives will result in widening of the road and the placement of artificial fill, to varying degrees, possibly on top of the buried archaeological site. Given current boundary information for CA-MRN-674, it remains inconclusive whether a particular bridge or road alternative would impact on the site because of the lack of site information below the current road surface of Pacific Way. Implementation of mitigation measure CR-MM-3 would clarify, and either reduce or eliminate this impact. Mitigation measure CR-MM-3 includes opening consultation with the State Historic Preservation Office in the event that the measure does not ensure that CA-MRN-674 will not be adversely affected.

Impact CR-B2: Disturbance to Previously Unidentified Cultural Resources During Construction (Long-Term, Year 0)

Impact mechanisms would be as described under Impact CR-R5.

Bridge Alternative BR0: Negligible. No actions would be taken that could expose previously undiscovered sites.

Bridge Alternatives BR1-BR4: Major Adverse. Under all action alternatives, construction would involve much surface disturbance and earthwork, which could expose and/or damage previously undiscovered buried cultural resources. Any impact on such sites would be significant. Mitigation measure CR-MM-1 would reduce this impact below significance thresholds.

Impact CR-B3: Disturbance to Previously Identified or Unidentified Cultural Resources During Site Evolution (Long-Term, Years 5 and 50)

Impact mechanisms would be as described under Impact CR-R6.

Bridge Alternative BR0: Negligible. While the landforms and structures associated with the No Action alternative help shape erosional/depositional patterns and/or the geomorphology of the site over time, the potential for such changes to affect cultural resources is considered speculative, and correspondingly is considered to be of low probability.

Bridge Alternatives BR1-BR4: Negligible: While the landforms and structures associated with all action alternatives help shape erosional/depositional patterns and/or the geomorphology of the site over time, the potential for such changes to affect cultural resources is considered speculative, and correspondingly is considered to be of low probability.

4.3.3.8 Fill Disposal Alternatives

Table 4.3.3-4 summarizes the potential impacts of Fill Disposal Alternatives to cultural resources in the study area. The Fill Disposal Alternatives are described in Chapter 2.

Table 4.3.3-4. Potential Cultural Resources Impacts from Fill Disposal Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail*	Mitigation Measure
CR-F1: Disturbance to Previously Unidentified Cultural Resources During Construction	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	**Major Adverse**/ Minor Adverse	CR-MM-1
CR-F2: Disturbance to Previously Unidentified Cultural Resources During Site Evolution	Negligible	Negligible	Negligible	Negligible	Negligible	
CR-F3: Disturbance to the "Fan Site"	Negligible	Negligible	Negligible	Negligible	**Moderate Adverse**/ Minor Adverse	CR-MM-1 CR-MM-4: Fence Off the Fan Site Fill Hauling So That Trucks Cannot Inadvertently Damage the Site

Note: The analysis of the two trail alternatives only considers the effects of hauling the fill to the sites. For the coastal trail, impacts of using the fill to recontour the trail are also considered.

Impact CR-F1: Disturbance to Previously Unidentified Cultural Resources During Construction (Long-Term, Year 0)

Impact mechanisms would be as described under Impact CR-R5.

All Fill Disposal Alternatives: Major Adverse. None of the fill disposal sites contain known cultural resources. Fill disposal activities may result in additional deposits overlying undiscovered buried resources, helping to preserve them in

their natural state. However, site access improvements to allow for fill disposal activities (e.g., construction of access roads) could expose and/or damage previously undiscovered buried cultural resources. Any impact on such sites would be significant. Mitigation measure CR-MM-1 would reduce this impact below significance thresholds.

Impact CR-F2: Disturbance to Previously Unidentified Cultural Resources During Site Evolution (Long-Term, Years 5 and 50)

None of the fill disposal activities is anticipated to result in changed site evolution over time that could affect undiscovered cultural resources.

All Fill Disposal Alternatives: Negligible.

Impact CR-F3: Disturbance to the "Fan Site" (Long-term, Year 0)

One of the fill disposal sites, the Coastal Trail, would use a truck route that passes through the Fan Site. Should road widening or other improvements be necessary, impacts to the site could occur.

Coastal Trail Alternative: Moderate Adverse. Implementation of mitigation measures CR-MM-1 and CR-MM4 would ensure impacts are less than significant.

All Other Fill Disposal Alternatives: Negligible. Fill hauling and disposal would not be located in proximity to the Fan Site.

4.3.3.9 Mitigation Measures

Mitigation Measure CR-MM-1: Cultural Resources Education, Archaeological Monitoring, and Discovery Measures.

NPS will conduct the following measures to ensure that there are no impacts to known and/or previously undiscovered cultural resources.

Cultural Resources Education for Workers

NPS will provide training to all members of the construction team. Training will involve information regarding what types of cultural materials are likely present in the project area, how to identify cultural materials, and the procedures for contacting the appropriate parties in the event that cultural materials are

encountered during construction activities. All construction personnel will be required to participate in the training, and NPS will prepare written guidelines for identification of cultural materials and procedures to follow in case of a discovery or potential discovery.

Archaeological Monitoring

NPS will ensure that there is an archaeological monitor and representative of the Federated Indians of the Graton Rancheria (Coast Miwok) within 100 feet of~~in the vicinity of~~ recorded archaeological resources during ground disturbing activities. While the goal of the NPS is to preserve archaeological resources, this mitigation measure would ensure that if additional deposits associated with known sites are discovered, there will be an archaeologist and Native American representative on site to identify and assess the find and impacts immediately and to halt construction.

An archaeologist will monitor all ground disturbances during construction to ensure that discoveries of previously unidentified resources are protected until they can be properly recorded and assessed, and management decisions can be made about their treatment. Avoidance in place or no adverse effect from project actions is the preferred approach to all discoveries that are potentially eligible for listing on the NRHP. Consultation with the State Historic Preservation Office will occur for any discoveries made during construction in accordance with 36 CFR 800.13.

Discovery of Archaeological Resources During Construction

If buried cultural resources such as chipped stone or groundstone, historic debris, building foundations, or human bone are inadvertently discovered during ground-disturbing activities, work should stop in that area and within a 100-foot radius of the find until a qualified archaeologist can assess the significance of the find.

Inadvertent discoveries will be treated in accordance with 36 CFR 800.13 (Protection of Historic Properties: Post-review discoveries). The archaeological resource will be assessed for its eligibility for listing on the NRHP in consultation with the SHPO and the Federated Indians of Graton Rancheria (if it is an indigenous archaeological site) and a determination of the project effects on the property will be made. If the site will be adversely affected, a treatment plan will also be prepared as needed during the assessment of the site's significance. Assessment of inadvertent discoveries may require archaeological excavations or archival research to determine resource significance. Treatment plans will fully evaluate avoidance, project redesign, and data recovery alternatives before outlining actions proposed to resolve adverse effects.

If human skeletal remains are encountered, protocols under either federal or state law may apply depending on the jurisdiction. Regardless, all work shall stop in the vicinity of the discovery, and the find will be secured and protected in place. The Marin County coroner and Park Archaeologist will both be immediately notified. If a determination finds that the remains are Native American, and that no further coroner investigation of the cause of death is required, the coroner will then be required to contact the NAHC (pursuant to Section7050.5[c] of the

California Health and Safety Code) and the County Coordinator of Indian Affairs. If the remains are on federal land or under federal jurisdiction, they will also be treated in accordance with the Native American Graves Protection and Repatriation Regulations at 43 CFR 10.4 (Inadvertent discoveries).

According to the California Health and Safety Code, six or more human burials at one location constitute a cemetery (Section 8100), and disturbance of Native American cemeteries is a felony (Section 7052).

Mitigation Measure CR-MM-2: Educate the Workers Conducting the Harding Grass Removal and Have an Archaeological Monitor in the Vicinity of the Fan Site.

NPS will provide training for all personnel involved with nonnative species removal to facilitate recognition of potential archaeological materials and to avoid impacts to deposits.

In addition, NPS will implement CR-MM-1 and retain an archaeologist to monitor in the vicinity of the Fan Site during Harding grass removal activities.

Mitigation Measure CR-MM-3: Limit Compaction Methods Above the Recorded Deposit; Consult with NPS, the County, and FIGR; and Clarify Site Disposition During the Design Process.

Compaction of the CA-MRN-674 may occur as a result of public access or bridge action alternatives. NPS will ensure that mechanical subsurface compaction does not occur in the vicinity of recorded deposits associated with CA-MRN-674. Consultation regarding project effects on CA-MRN-674 will be conducted between the National Park Service, the County of Marin, and the Federated Indians of Graton Rancheria as the final design for the bridge and access are in preparation, and may include additional subsurface surveys, possibly conducted as part of geotechnical borings, to clarify the status of CA-MRN-674 under portions of Pacific Way. If this assessment results in a finding of adverse effect, then the National Park Service will consult with the SHPO, in addition to the County of Marin and the Federated Indians of Graton Rancheria, to resolve the adverse effect.

Mitigation Measure CR-MM-4: Fence Off the Fan Site Fill Hauling So That Trucks Cannot Inadvertently Damage the Site

To avoid inadvertent truck damage to the Fan Site, NPS will fence off the archaeological deposit during the period of time when truck traffic would be traveling this route.

Exhibit 2: Final Environmental Impact Statement

4.3.4 Social Resources

4.3.4.1 Recreation and Visitor Experience

Guiding Regulations and Policies

The *Visitor Use* section of NPS's Management Policies 2006 (Section 8.2) identifies the enjoyment of park resources and values by the people of the United States as part of the fundamental purpose of all national parks. NPS is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks, and to maintaining a park atmosphere that is open, inviting, and accessible to every segment of American society. NPS policies specifically emphasize the need to provide "forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks." NPS defers the responsibility to meet the broader spectrum of recreational needs not dependent on a national park setting to other federal agencies and to state and local governments.

NPS encourages visitor activities that:

- are appropriate to the purpose for which each park was established;
- are inspirational, educational, or healthful, and otherwise appropriate to the park environment;
- will foster an understanding and appreciation of park resources and values, or will promote enjoyment through a direct association with, interaction with, or relation to park resources; and
- can be sustained without causing unacceptable impacts on park resources or values.

Unless mandated by statute, NPS does not allow visitor activities that are contrary to the purposes for which a specific park was established; or that would impair park resources or values, or create an unsafe or unhealthful environment for other visitors or employees. NPS also prohibits activities that would unreasonably interfere with the peaceful atmosphere or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within any park; or with other existing appropriate park uses. Similar prohibitions apply to activities that would interfere with NPS interpretive or visitor service activities; NPS administrative activities; and NPS concessionaire and contractor operations or services.

Redwood Creek Watershed Vision for the Future

Recognizing the ecological and recreational importance of the Redwood Creek watershed, a number of local agencies recently undertook a year-long process to identify a vision for long-term management of the watershed and its resources. The visioning process was conceived as the first step in developing a more concrete watershed management framework. Agency partners in the visioning process included NPS, the California Department of Parks and Recreation and Department of Fish and Game, the Marin Municipal Water District, the County of Marin, and the Muir Beach Community Services District (Redwood Creek Watershed Vision Team 2006). The process also included extensive public outreach (National Park Service 2003).

The *Redwood Creek Watershed Vision for the Future* encompasses descriptions of "desired future conditions" for a variety of aspects of watershed function and use. Following are the conditions that define the vision for visitor experience of the watershed (National Park Service 2003).

1. Visitor experiences that are unique to this watershed are encouraged.
2. The watershed provides a range of visitor experiences from wild to structured and from solitary to shared.
3. Access to the watershed and recreational opportunities are provided for a range of trail users through a well-designed, comprehensive trail system.
4. Visitor uses and use levels are compatible with protection of natural and cultural resources of the watershed and visitor enjoyment.
5. Public education about watersheds, watershed management, and resource sustainability is provided through a range of programs both within and outside of the watershed.
6. Visitors to the watershed are active stewards of watershed resources as volunteers, educators, students, land managers, and citizen experts.
7. People visit the watershed in a manner that minimizes traffic congestion and its related negative impacts to communities and watershed resources.

Equestrian Uses Planning

NPS is currently in the process of developing a comprehensive management plan for equestrian facilities and uses within the southern Marin County portion of the GGNRA, including the Presidio Riding Club stables in the Marin Headlands, the Miwok Stables in Mill Valley, and the Golden Gate Dairy stables in Muir Beach. The proposed *Southern Marin Equestrian Plan* will describe and identify ways to enhance existing public outreach and equestrian programs, identify options for future use of these three facilities; address site and facility needs, including needed improvements; and define approaches to protect important natural and cultural resources at and around each site. NPS is preparing an environmental assessment to evaluate a range of alternatives for the plan pursuant to NEPA. (National Park Service 2006a).

Study Area

The study area for recreation and visitor experience includes the entire project area, as described in Chapter 2 and shown in Figure 2-1.

Analysis Thresholds

Effects on recreation and the visitor experience were evaluated as *negligible*, *minor*, *moderate*, or *major*, based on the thresholds described below. The thresholds for each effect category were developed from NPS management objectives.

- **Negligible:** Alternative would result in little or no noticeable change in visitor experience or appreciation of the site, or recreation opportunities. Visitors are likely be unaware of the effects associated with proposed changes at the site.
- **Minor:** Alternative would result in changes detectable to the visitor and Muir Beach community, but would not affect normal visitor use or reduce visitor enjoyment of the site. Visitors would be aware of the effects associated with the changes proposed; however, alterations in visitor use and experience would be slight and short-term. Other aspects of the Muir Beach experience would remain available for visitor use and enjoyment without degradation of site resources and values.
- **Moderate:** Alternative would result in changes readily apparent to the visitor and Muir Beach community, and would affect visitor use. Access and/or recreational opportunities would be altered, and enjoyment of the area would be measurably affected (visitors could either be more satisfied or less satisfied). Some visitors would be likely to pursue their recreational choice at another location.
- **Major:** Alternative would result in long-term changes that would be highly noticeable to the visitor and Muir Beach community, and intrusive to the visitor experience. Alternative would also likely change the character of the landscape or soundscape, and/or change important vistas or keystone features of the site. Original, pre-project perceptions of the area and traditional visitor uses at the site would be highly altered. Some visitors wishing to continue their use and enjoyment of Muir Beach would be required to pursue their choice in other available local or regional areas to obtain the desired experience.

Methods and Assumptions

Potential effects on recreation and the visitor experience were evaluated consistent with the criteria presented in *Analysis Thresholds* above. This entailed identifying the physical changes in site conditions expected to occur under each

alternative and then evaluating whether any anticipated site changes would be likely to:

- alter visitor perception of the site or enjoyment of existing uses at the site;
- eliminate or reduce existing uses, or provide new and/or beneficially modified uses;
- create or relieve conflicts between designated uses; or
- otherwise contribute to increases or decreases in use at the site.

Analysis addressed short-term (temporary) construction-related impacts, mid-term changes in the site as restored habitat evolves toward maturity in the years immediately following restoration, and long-term (effectively permanent) post-restoration site changes. All anticipated changes in site condition (temporary, mid-term, and long-term) were evaluated under the following criteria, which reflect factors identified as essential to the quality of the visitor experience.

- **Access**
  - Vehicle, bicycle, public transit, and pedestrian access to, from, and within the site.
  - Parking lot design and capacity during peak demand periods, and potential for parking lot to either physically, audibly, or visually intrude on the visitor's experience or improve visitor experience.
  - Location and accessibility of trails, boardwalks, viewing areas, and other interpretive facilities.
  - Location and accessibility of picnic area and restrooms.
  - Trail connectivity for hikers and equestrians.
- **Recreational Opportunities and Visitor Experience**
  - Availability and quality of various recreational opportunities, such as walking, hiking, and birding.
  - Ability of the site to reveal the site's natural processes at work (e.g., the interconnectedness of the creek, wetlands, dunes, beach, and ocean) and educate the visitor on watershed issues, the human history of the area, and current restoration efforts.
  - Visitor profile/demographic, number of visitors.
- **Community Relationships**
  - Relationship between visitors and area residents.

NPS also identifies safety of visitors and area residents as a priority. Accordingly, restoration and public access construction activities were also analyzed for their potential to affect the safety of visitors and area residents, including all age groups and those with disabilities. No additional analysis of

long-term safety implications was identified as necessary. All facilities would be designed and operated to meet applicable safety and accessibility (ADA) standards. Thus, long-term adverse effects on safety are not expected as an outcome of any action alternative, and operational safety concerns are not expected to be a meaningful discriminator between alternatives.

Key sources of information used in this analysis included.

- Relevant NPS planning documents and policies.
- University of Vermont visitor management research at Muir Woods and Muir Beach (Manning and Budruk 2003).
- NPS personnel involved in public outreach, planning, and interpretive efforts at Muir Beach and elsewhere in Marin County.
- Photographs and maps of existing site conditions; plans showing proposed changes in access, parking, trails, boardwalks, picnic area, and other visitor facilities.
- Direct field observation at the site by Jones & Stokes recreation specialists.

Restoration Alternatives

The table below summarizes the anticipated effects of the four Restoration Alternatives on recreational uses in the study area. The Restoration Alternatives are described in Chapter 2. Detailed analysis of impacts on access, recreational opportunities/visitor experience, and community relationships follows the table.

Table 4.3.4.1-1. Potential Recreational Use Impacts from Restoration Alternatives

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				Mitigation
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
REC-R1: Reduced Recreational Opportunities and Visual and Noise Disturbance During Construction	Negligible	**Moderate Adverse**	**Moderate Adverse**	**Moderate Adverse**	NPS's public information outreach commitments would reduce this impact to the extent feasible. No additional mitigation has been identified as feasible and effective.
REC-R2: Visual and Noise Disturbance as a Result of Interim Flood Reduction Measures	Negligible	Negligible	Negligible	Negligible	
REC-R3: Altered Visitor Perception and Use of Site During Early Years of Site Recovery	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	
REC-R4: Effects of Restoration on Visitor Experience During the Life of the Project—Birding, Nature-Watching, and Other General Site Uses	Negligible	Major Beneficial	Major Beneficial	Major Beneficial	
REC-R5: Effects of Restoration on Visitor Experience During the Life of the Project—Equestrian Uses	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	
REC-R6: Effects on Visitor Profile and Number of Visitors to the Site	Negligible	Negligible	Negligible	Negligible	
REC-R7: Short-Term Effects on Visitor Safety During Restoration Construction	Negligible	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	REC-MM-1: Construction Exclusion Areas REC-MM-2: Horse and Equestrian Safety Measures
REC-R8: Effects of Restoration Alternatives on Resident/Visitor Interaction	Negligible	Negligible	Negligible	Negligible	

Restoration Alternatives—Effects on Access

Public access to Muir Beach would be affected only by the project components that directly address site access—the parking lot and bridge alternatives. Effects as a result of these components are addressed separately below. Access to natural habitat areas at Muir Beach is currently controlled and would be controlled in a similar manner and to a similar extent under all restoration alternatives; none of the restoration alternatives is expected to materially increase, decrease, or alter the quality of public access for area residents and out-of-town visitors within the site.

Restoration Alternatives—Effects on Recreational Opportunities and Visitor Experience

Impact REC-R1: Reduced Recreational Opportunities and Visual and Noise Disturbance During Construction (Short-Term, Year 0)

Under the No Action Alternative (Alternative 1), Redwood Creek would remain in its current alignment; no active modification of the site's natural or built features is planned, although periodic maintenance of the channel and recreational facilities would continue to be necessary, and could occasion temporary closures probably similar in duration and extent to those that occur now. Because no facilities modification or habitat restoration is planned under Alternative 1, Alternative 1 would not result in construction-related effects on recreational opportunities.

By contrast, all of the action alternatives would entail earthwork and restoration to relocate the Redwood Creek channel; construct a new drainage swale in the upper pasture area; and enhance backbeach lagoon, channel, and dune habitats. All of the action alternatives would also remove the levee road, levee, and associated utilities; the Muir Beach Tavern ruins; and hardscape elements in the Redwood Creek channel. Invasive exotic vegetation would also be removed.

Active demolition, earthwork, and construction areas would need to be closed to the public for safety reasons, as would the area(s) used to stage equipment and materials. Additional closures would probably be required for activities such as exotic vegetation removal. Closing parts of the Muir Beach site would directly reduce availability of some recreational activities. For instance, closure and removal of the levee road would preclude its use by equestrians and hikers. This is expected to be a particular concern for equestrians, who currently make heavy use of the levee road loop. It would also be a concern for area residents who rely on the loop as a regular walking/running/hiking route, and would probably affect these regular users to a greater degree than out-of-town visitors, who might be more likely to walk on the beach than to use local trails.

In addition, areas subject to grading and recontouring would be highly disturbed during the active construction window; most visitors would probably experience their visual quality as markedly reduced during and following construction (see related discussion in Section 4.3.4.3, *Aesthetics*). Removal of invasive nonnative

vegetation would likely add to the perception of visual disturbance during this timeframe by decreasing and temporarily disturbing vegetative cover, and would in turn also reduce bird and wildlife use of treated areas. In combination, visual disturbance and reduced use by birds and wildlife would decrease the "wild" or "natural" character of the site and environs; most visitors are expected to consider this an adverse effect.

Construction noise would also detract from the visitor experience, as discussed in Section 4.3.4.7, *Noise*.

A substantial percentage of Muir Beach users report that the site's natural beauty, calm atmosphere, and sense of remoteness/isolation are among its most important qualities (Manning and Budruk 2003). Construction closures and visual and noise disturbance are thus likely to affect a wide range of site visitors. Local resident users of the beach and associated facilities might be expected to find it most frustrating, particularly those who visit Muir Beach often and have come to rely on these resources as a regular part of their lives. Construction disturbance would unlikely be a substantial concern for visitors and residents at Green Gulch Farm contemplative retreats and other events, who typically place a high value on the peaceful and serene natural resources around the Farm. As discussed in Section 4.3.4.7, *Noise*, there is low potential for construction noise to disturb retreat participants at the Farm itself, but the greatest concern would be effects of noise on Green Gulch Farm's regularly scheduled meditative beach walks, which depend on a quiet environment. Construction closures and disturbance could also prove to be a substantial disappointment for out-of-town visitors, particularly if they are surprised by active construction where they expected to visit a peaceful beach/lagoon setting.

Mitigation for construction noise effects identified in Section 4.3.4.7, *Noise* would help to reduce the effects of construction on the recreational experience. The emotional effect of temporary site closures and altered site aesthetics during construction would be further addressed by NPS's commitment to keep the public fully informed on project planning and progress (see *Communication Strategy* in Chapter 2). Signage, noticing, public meetings, and other outreach tools would help visitors to understand the reasons for the changes taking place, which would be expected to reduce frustration among local users of the facility in particular, because—although unquestionably the most affected by restoration construction—they also stand to receive the greatest and most persistent benefit from long-term restoration success. NPS's commitment to involve volunteers as stewards via active participation in restoration activities would also help to build awareness of the project's potential benefits, and offer residents an opportunity to make a positive difference by working actively toward restoration success. This could be viewed as replacing one type of recreational activity (beachcombing, birding, etc.) with another (active participation in restoration stewardship). Such opportunities would likely be welcomed by many Muir Beach users—in the 2003 user survey, the majority of respondents indicated that they would like to see NPS provide more opportunities for education about the area's natural history, and more opportunities to volunteer for conservation projects (Manning and Budruk 2003).

Redirecting visitors to other facilities not undergoing active construction would also help to reduce effects on the recreational experience by offering site users alternatives to Muir Beach. This would be particularly helpful in buffering effects on tourists and other out-of-area users, who would be unlikely to develop the same sense of participation and ownership as area residents, and also are more able to redirect their use.

In addition to generalized impacts affecting most or all site uses, additional impacts specific to equestrians are also likely. Although all action alternatives would maintain the existing horse stalls at the corner of Hwy 1 and Pacific Way, horses stabled there would likely need to be relocated during construction to avoid undue distress and potential health effects; horses are very sensitive to elevated noise levels and particularly to loud sudden noises. Horses pastured in Green Gulch Farm's Field 7—a maximum of four at any given time—would also likely need to be relocated briefly while the Monterey cypress windbreak is removed and while the Green Gulch tributaries and adjacent wetlands are excavated. This would temporarily reduce the local availability of long- and short-term horse boarding, and could represent a financial concern for owners (who might need to pay for additional, alternate accommodations) and for the Farm (who would likely lose revenues during the relocation periods), unless horses can be relocated temporarily within the existing facilities. Horses that are often temporarily held in the stalls at the corner of Hwy 1 and Pacific Way would not be able to stay there during many construction activities, such as construction of the bridge and road and during other construction activities, such as the new channel construction and upgrade of the new emergency access road.

Restoration Alternative 1: Negligible. No construction-related change in the availability or quality of recreation at Muir Beach is anticipated under Alternative 1, because Alternative 1 would maintain existing conditions at the site. There would be no impact.

Restoration Alternatives 2, 3, 4: Moderate Adverse. The general nature of construction activities would be similar under all three action alternatives. The principal difference between the alternatives would be the duration of construction. Under Alternative 2, construction would take place during the summer months of 3 consecutive years. Under Alternatives 3 and 4, which propose more extensive construction, an additional summer would be required. Since construction would result in readily apparent changes likely to be experienced as negative by most visitors, and would alter visitor use of the site, effects are evaluated as moderate and adverse for all three action alternatives, but would be greater under Alternatives 3 and 4 than under Alternative 2.

With mitigation for construction noise and visual disturbance, as well as NPS's commitment to keep the public informed on project progress, ensure that visitors are redirected to alternate facilities, and provide opportunities for public involvement and stewardship, overall impacts related to reduced recreational opportunities and visual and noise disturbance of all recreational uses during construction would be reduced to the extent feasible, but they are nonetheless considered significant.

Because of the small number of horses and owners potentially affected, and the comparatively short duration of the impact (a portion of the total construction window under any given alternative), additional impacts specific to equestrians are identified as minor and adverse, and are considered less than significant. No additional mitigation is required for these impacts.

Impact REC-R2: Visual and Noise Disturbance as a Result of Interim Flood Reduction Measures (Short-Term, Year 0)

All action alternatives would include activities to reduce flood risk during the construction period. As discussed in Chapter 2, this is necessary because construction likely would not be completed until about 2010, so the site would experience several flood seasons before the restored channel and other modifications are in place and fully functional. Interim flood reduction activities would focus on maintaining flow under the existing Pacific Way Bridge during low magnitude events, and would entail excavating the channel from about 400 feet upstream of the bridge to about 100 feet downstream of the bridge. This may be required in more than one year, depending on rates of sediment aggradation.

Use of heavy equipment to remove sediment from the stream channel would result in some degree of visual and noise disturbance to recreational visitors, including local users of the site and out-of-town visitors. However, the duration of activities would be restricted, and the nature and extent of activities would be similar to flood reduction activities intermittently necessary under existing conditions.

Restoration Alternatives 1, 2, 3, 4: Negligible. Under the Restoration Alternative 1, there would be no change from existing conditions or procedures.

Interim flood reduction measures would be implemented under all three action alternatives. However, the nature and extent of activities would be similar to intermittent channel maintenance required under existing conditions, so the change from existing conditions and procedures, and the project-related effect on recreational visitors, is expected to be negligible. Impacts would be less than significant, and no mitigation is required.

Impact REC-R3: Altered Visitor Perception and Use of Site During Early Years of Site Recovery (Short-Term, Year 5)

Effects and public perceptions during the early years of post-restoration site recovery would likely be similar to those described above for the active construction window. Under the No Action Alternative, there would be no construction, no need for site recovery, and no project-related change in site access or appearance. By contrast, under all three action alternatives, the site would undergo substantial recontouring, construction, and replanting, and would require some time to recover and regain a more natural, undisturbed appearance. Soon after the completion of construction, the new trails would be opened to public use, so new recreational opportunities would become available to replace those discontinued to accommodate restoration. The site would continue to present a somewhat disturbed and altered appearance until vegetation becomes well established. Some recreational visitors may experience this as a detriment,

but it would also create an opportunity for outreach and public education about habitat restoration, natural processes, and recovery from human disturbance of the landscape, potentially offsetting the detriment for some visitors. As identified above, the majority of respondents in the 2003 user survey indicated that they would like to see NPS provide more opportunities for public education about natural resources at Muir Beach (Manning and Budruk 2003).

Public perceptions during this transitional phase are likely to be mixed. It is difficult to predict reactions within each user group, although as a generality local users are expected to be more invested in restoration as a process than casual visitors.

Some visitors would be happy to see restoration proceeding and excited about the new trails and other facilities improvements as well as the opportunity to observe and participate in the site's recovery; as discussed above, most users appear to support increasing opportunities for public education and for volunteer involvement in conservation. This is expected to be particularly true for local users, most of whom are deeply concerned about the character, quality, and integrity of local natural resources. It would likely also be true for many out-of-town visitors, who would value the learning opportunity presented by restoration, and appreciate NPS's stewardship of the site. By contrast, other users—probably a minority, including local residents reluctant to see change in resources they depend on, as well as casual visitors disappointed not to see a more "natural" appearing beach setting—may be distressed by the site's rather raw, unfinished appearance during the early post-restoration years.

User reactions are also likely to correlate to some extent with the degree to which restoration and facilities improvements are perceived as addressing specific needs. For instance, as identified above, equestrians and local-user hikers, walkers, and runners in particular are expected to be concerned about the loss of the levee road trail loop; their reactions during the early post-restoration period would depend on the extent to which they feel their needs are served by the proposed new trails, including the appearance of restored areas.

Restoration Alternative 1: Negligible. Because there would be no construction, and hence no site recovery period, under the No Action Alternative, there would be no project-related impacts.

Restoration Alternatives 2, 3, 4: Minor Beneficial. Post-restoration changes in the site would be marked, and even with educational/interpretive materials in place some visitors may experience the site as adversely altered during the post-restoration recovery period, particularly during the first few years as vegetation is just beginning to establish. However, the majority of users are expected to view alterations in the site as an overall positive change.

Effects would differ slightly between the three action alternatives—Alternative 2 would emphasize new riparian habitat, while acreages of open water would be greatest under Alternative 4. Because Alternative 2 would entail creation of more than 10 acres of new riparian habitat, which take a number of years to mature, as

well as substantial realignment of Redwood Creek, this alternative is likely to result in the most disturbed appearance from a visitor perspective. All three of the action alternatives could entail sufficient site alteration that some visitors would choose to recreate elsewhere. From the perspective of these users, effects would be adverse, and would likely be reduced but probably not entirely avoided by NPS's planned outreach and public involvement (stewardship) activities. However, such users are expected to be in the minority. Most users, including both the local population and out-of-town visitors, are expected to regard restoration as a positive process and be excited about post-restoration changes in the site. The site may even attract visitors solely to observe the restoration process. Consequently, alterations in visitor perception and use of the site during the early years of site recovery, while representing minor adverse effects for a minority of users, would represent minor beneficial changes or benefits for the majority of site users. Effects are thus considered minor and beneficial overall.

Impact REC-R4: Effects of Restoration on Visitor Experience During the Life of the Project—Birding, Nature-Watching, and Other General Site Uses (Long-Term, Year 50)

Under the No Action Alternative (Alternative 1), no habitat restoration or modification of facilities is proposed, so long-term post-project conditions would not be altered.

Under the three Restoration Alternatives, habitats on the site would be substantially altered. Alternative 2 would emphasize riparian habitat, replacing much of the existing extent of degraded wetland with riparian woodland; Alternative 3 would create a combination of restored wetland, riparian, and open water (lagoonal) habitat; and Alternative 4 would emphasize open water in a large restored lagoon. By Year 50, all action alternatives would be expected to have reached a state of dynamic equilibrium with a naturally functional creek and/or lagoon system and mature vegetation. Thus, under all three action alternatives, site aesthetics at Year 50 are likely to be perceived as improved by comparison with existing conditions, representing a general benefit for all recreational uses. Specific impacts would vary by alternative and use, as summarized below.

All three of the Restoration Alternatives would change the habitat mosaic at the site substantially, which in turn would likely alter wildlife, and, particularly bird use, with the potential to alter birding and nature-watching opportunities at and surrounding the site. At present, in addition to the beach, the site is dominated by degraded wetlands with limited open water (lagoon), beach, and riparian habitat also available. A large number of bird species have been reported from the site, including waterfowl such as loons, grebes, and a variety of ducks; pelicans; gulls; shorebirds; raptors; and passerine birds. In general, bird usage at Muir Beach/Big Lagoon reflects coastal riparian and wetland species assemblages that vary seasonally according to the breeding and wintering habits of each species. Riparian birds are probably the most conspicuous species at the site—surveys suggest that overall waterbird diversity is low (many species have been reported, but use appears to be dominated by comparatively common species such as mallards, killdeer, and bufflehead), and riparian habitats are the most heavily

used throughout the year (Philip Williams & Associates 2003; see related discussion in Section 3.2.2, *Wildlife*).

All three Restoration Alternatives would improve habitat quality and function, and thus would likely increase bird usage and bird species diversity at the site, in turn improving birding and nature-watching opportunities. Under Alternative 2, with its emphasis on riparian habitat, bird use is most likely to resemble an improved version of the existing condition, with riparian usage dominant, and a wide range of riparian, wetland, and to a lesser extent open-water species present. Under Alternative 3, which would balance riparian, wetland, and open-water (lagoonal) restoration, species would be similarly diverse, or even more so. Under Alternative 4, which emphasizes open water, species would be less diverse, but there would be substantially improved opportunities to observe waterfowl.

Restoration Alternative 1: Negligible. Since the No Action Alternative (Alternative 1) would not restore habitat or modify facilities, there would be no long-term project-related impacts on recreation and visitor experience.

Restoration Alternatives 2, 3, 4: Major Beneficial. All three Restoration Alternatives would improve habitat quality and function over the long term; by year 50, restored habitat is expected to be well established, such that it would represent a substantial aesthetic and educational benefit to recreation and the quality of the visitor experience. Birding and nature-watching in particular would benefit from the anticipated increase in bird use and diversity. Other site uses, such as picnicking, beachcombing, and trail walking/running/hiking would also benefit substantially. Impacts would be beneficial.

Impact REC-R5: Effects of Restoration on Visitor Experience During the Life of the Project—Equestrian Uses (Long-Term, Year 50)

Under the No Action Alternative (Alternative 1), no habitat restoration or modification of facilities is proposed, so long-term post-project conditions would not be altered.

As discussed under Impact REC-R3 above, all three Restoration Alternatives would substantially alter habitats on the site over the long term, with Alternative 2 emphasizing riparian habitat, Alternative 3 creating a combination of restored wetland, riparian, and lagoonal habitat; and Alternative 4 emphasizing open water in a large restored lagoon. By Year 50, all action alternatives would be expected to have reached a state of dynamic equilibrium with a naturally functional creek and/or lagoon system and mature vegetation. Thus, under all three action alternatives, site aesthetics at Year 50 would be improved by comparison with existing conditions, representing a general benefit for all recreational uses, and some level of aesthetic benefit for equestrian uses in particular.

However, all action alternatives would use about 25 percent of the existing acreage of Green Gulch Farm's Field 7 for habitat restoration. As identified in the *Affected Environment* discussion for recreation and visitor experience

(Section 3.4.1), Field 7 currently provides pasturage for four horses belonging to Ocean Riders. Following restoration, with the reduction in pasture acreage, Field 7 is expected to support only three horses. In addition, the riding ring west of the access road would be removed to accommodate restoration although the stalls in this area are expected to remain available over the long term. The riding ring is currently used only in the summer because it is too wet for use in most winters, and is used primarily for turning horses out rather than for schooling or other "ring-specific" uses; the loss of the riding ring thus would further decrease the availability of temporary pasturage, and this loss in particular is expected to affect visiting equestrians, who are the heaviest users of the ring.

Restoration Alternative 1: Negligible. Since the No Action Alternative (Alternative 1) would not restore habitat or modify facilities, there would be no long-term project-related impacts on recreation and visitor experience.

Restoration Alternatives 2, 3, 4: Moderate Beneficial. As identified above, all three Restoration Alternatives would improve habitat quality and function over the long term; by year 50, restored habitat is expected to be well established, representing a substantial aesthetic and educational benefit to the visitor experience, including that of equestrians. However, there would be also be some long-term detriment to equestrian uses, related to the partial loss of Field 7 pasturage and the riding ring at Green Gulch Farm, which is also used primarily for pasturage. The loss of Field 7 pasturage is identified as a minor adverse effect because only one horse would be affected. The loss of the riding ring would affect a larger number of horses and riders, potentially causing some out-of-area uses to select another destination, and thus is identified as a moderate adverse effect. However, the overall number of equestrians affected is likely to be small compared to the total number of equestrians using the site and broader region, and the fact that there are plentiful equestrian opportunities in the vicinity of the project. Overall effects to visitors are expected to be moderately beneficial.

Impact REC-R6: Effects on Visitor Profile and Number of Visitors to the Site (Long-Term, Year 50)

Under the No Action Alternative (Alternative 1), no change in either the number of the visitors or the overall visitor profile is anticipated.

The three Restoration Alternatives would alter the habitat mosaic on the site and would slightly alter the recreational opportunities available, providing additional benefit for birders and nature-watchers and slightly decreasing opportunities for equestrian use, as discussed above. Each year, a small number of visits might be generated by people who come specifically to see the restored habitats. However, this is not expected to be a major component of site use—overall, all existing uses are expected to continue and most would be enhanced; neither the number of visitors nor the visitor profile is expected to change substantially as a result of habitat restoration.

Restoration Alternatives 1, 2, 3, 4: Negligible. Neither the No Action Alternative nor any of the Restoration Alternatives is expected to materially alter either the visitor profile or the number of visitors to the site over the long term.

Restoration Alternatives—Safety Effects

Impact REC-R7: Short-Term Effects on Visitor Safety During Restoration Construction (Short-Term, Year 0)

Under all Restoration Alternatives, construction activities—especially the use of heavy equipment—would have some potential to pose a safety risk to visitors engaged in all uses, if visitors are not excluded from active work sites and equipment travel routes. There could be some additional risk specific to equestrians. Construction can generate loud noises, and horses are highly sensitive to loud noises; loud sudden noises in particular can cause them to shy, bolt, or otherwise behave unpredictably. Inexperienced riders can be at particular risk of injury in such situations, and horses can also injure themselves when frightened.

Note that since no construction would take place under the No Action Alternatives (Alternative 1), the No Action Alternative would have no potential to change visitor safety conditions.

Restoration Alternative 1: Negligible. Because no construction activity would take place, there would be no impact.

Restoration Alternatives 2, 3, 4: Moderate Adverse. Safety risks to visitors are potentially significant, but could be addressed by implementing mitigation measures REC-MM-1, creating construction exclusion zones and REC-MM-2, implementing horse and equestrian safety measures. With these measures in place, construction-related impacts on visitor safety would be less than significant.

Restoration Alternatives—Effects on Community Relationships

Impact REC-R8: Effects of Restoration Alternatives on Resident/Visitor Interaction (Individual, Long-Term, Years 5 and 50)

The No Action Alternative would not materially alter site conditions or uses; consequently, it would not alter resident/visitor relationships. Similarly, although the action alternatives would alter site conditions, and could lead to minor alterations in site uses, none of the three alternatives is expected to alter uses to an extent or in a manner that would affect relationships between the resident and visitor communities.

Restoration Alternatives 1, 2, 3, 4: Negligible. Impacts would be less than significant under all alternatives.

Public Access Alternatives

This table summarizes the potential impacts of Public Access Alternatives to recreation and the visitor experience. The Public Access Alternatives are described in Chapter 2. Detailed analysis of impacts on access, recreational opportunities/visitor experience, visitor safety, and community relationships follows the table.

Table 4.3.4.1-2. Potential Recreation and Visitor Experience Impacts from Public Access Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							
Impact	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	Mitigation
REC-P1: Reduced Resident and Visitor Access, Visitor Amenities, and Recreational Opportunities During Construction	Negligible	**Moderate Adverse**	**Moderate Adverse**	**Moderate Adverse**	**Moderate Adverse**	**Moderate Adverse**	**Moderate Adverse**	No feasible mitigation identified.
REC-P2: Effects of Parking Lot Configuration and Siting on Recreational Opportunities and Visitor Experience	Negligible	**Major Adverse**	Minor Adverse	Negligible	Minor Beneficial	Minor Beneficial	**Moderate Adverse**	No feasible mitigation identified.
REC-P3: Effects of Visitor Amenities on Recreational Opportunities and Visitor Experience	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	
REC-P4: Short-Term Effects on Visitor Safety During Public Access Construction	Negligible	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	REC-MM-1: Construction Exclusion Areas REC-MM-2: Horse and Equestrian

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							Mitigation
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
								Safety Measures
REC-P5: Effects of Parking Lot Configuration and Siting On Community Relationships	Negligible	**Major Adverse**	**Moderate Adverse**	Negligible	Minor Beneficial	Moderate Beneficial	Minor Beneficial	No feasible mitigation has been identified.

Public Access Alternatives—Effects on Access

Impact REC-P1: Reduced Resident and Visitor Access, Visitor Amenities, and Recreational Opportunities During Construction (Short-Term, Year 0)

Under the No Action Alternative (Alternative A), the parking lot would remain in its existing location adjacent to the beach, and would continue to accommodate its present capacity of 175 cars. Other visitor access would also remain unchanged. No access-related construction would take place, and there would be no construction impacts under this alternative.

Each of the six action alternatives would entail some level of construction. Under Alternatives B1 through B5, the parking lot would be modified to change its capacity, but would remain in approximately its existing location adjacent to the beach; visitors would access the beach directly via a short boardwalk. Parking lot capacities would be as follows: Alternative B1—50 cars; Alternative B2—145 cars; Alternative B3—175 cars; Alternative B4—175 cars with lot rotated parallel to Pacific Way; and Alternative B5—200 cars. Under Alternative C, a new 118-car parking lot would be constructed at Alder Grove, with 14 disabled-accessible spaces and a drop-off zone provided at the beach. Visitors would access the beach via a 0.5-mile pedestrian trail through the grove. Under all action alternatives (B1 through B5, C), the existing parking lot area would be used for construction staging, and would also undergo reconfiguration during a portion of the construction process. Available parking capacity would be reduced for most of the construction window, and the existing parking lot, picnic area, and beach and trail access would be temporarily closed for certain shorter periods. This would reduce the availability of beachcombing, hiking, equestrian, and birding/nature-watching uses during part or all of the construction window. In addition to reduced availability of facilities and recreational uses, construction noise and the visual disturbance associated with construction activity in an otherwise serene natural setting could further degrade visitors' experience of the site.

As discussed above for construction of the restoration alternatives, local users of the beach and associated facilities would likely be most affected by access construction, particularly users who visit Muir Beach often and rely on its recreational resources as a regular part of their lives. Construction disturbance would also be a substantial concern for Green Gulch Farm retreat participants, who are expected to place a high value on the peaceful and serene natural resources around the Farm. Difficult access and construction-related closures could also prove to be a substantial disappointment for out-of-town visitors, particularly if they are surprised by active construction where they expected to visit a peaceful beach/lagoon setting.

Public Access Alternative A: Negligible. No construction—and hence, no construction-related disturbance of recreational uses—would occur under the No Action Alternative. There would be no impact.

Public Access Alternatives B1–B5, C: Moderate Adverse. For all action alternatives, the level of disruption to public access and recreational use during construction would be readily apparent, and could be sufficient to discourage visitors from using Muir Beach. However, many forms of disruption would be comparatively short-term, limited in most cases to a portion of the site and/or construction window. As a result, effects are evaluated as moderate and adverse. NPS's commitment to keep the public informed about the project (need for restoration, restoration planning, project progress, etc.) would help to alleviate the emotional impact of access and use disruption. Public noticing would also help out-of-town recreational visitors find alternate sites offering similar uses. With these commitments in place, impacts would be reduced to the extent feasible, but are nonetheless considered significant.

Public Access Alternatives—Effects on Recreational Opportunities and Visitor Experience

Impact REC-P2: Effects of Parking Lot Configuration and Siting on Recreational Opportunities and Visitor Experience (Long-Term, Years 5 and 50)

Under the No Action Alternative (Alternative A), parking would remain in its current configuration, with 175 cars accommodated in the existing lot near the beach. There would be no change in the way parking supports public use of the facilities at Muir Beach, and thus no impacts on recreational opportunities or the visitor experience.

All of the action alternatives focus on modifications to parking capacity and configuration. Parking capacity has the potential to affect recreational opportunities and visitor experience in several ways. First, the availability of parking represents a physical constraint on the number of vehicles (and hence, the number of people) able to access the facilities at any given time; this translates into a constraint on the availability of recreational opportunities at the site. Additionally, if the demand for site use is greater than available parking can accommodate, the overflow can result in queues waiting for parking, or create

additional local vehicle traffic as recreational visitors "orbit" the site waiting for parking to become available. Experience at Muir Beach and other area facilities such as Muir Woods National Monument also suggests that some visitors may park illegally on access roads or in adjacent residential areas, creating additional traffic congestion and potential frustration both for local residents and for other visitors. Anecdotal evidence further indicates that ease or difficulty in finding parking and physically accessing the site is a key aspect of a positive or negative visitor experience.

As discussed above, Alternatives B1, B2, and~~through~~ B5 would modify parking capacity, but the lot would remain in approximately its existing location adjacent to the beach, with visitors accessing the beach directly via a short boardwalk. Parking lot capacities would be as follows: Alternative B1—50 cars; Alternative B2—145 cars; Alternative B3—175 cars; Alternative B4—175 cars with lot rotated parallel to Pacific Way; and Alternative B5—200 cars. Alternative C would modify public access more substantially; under this scenario, a new 118-car parking lot would be constructed at Alder Grove, with 14 disabled-accessible spaces and a drop-off zone provided at the beach. Visitors would access the beach via a 0.5-mile pedestrian trail through the grove.

Table 4.3.4.1-3 summarizes existing parking demand and compares it to parking availability under Alternatives B1 through C, highlighting projected shortfalls.[1] The No Action Alternative is also shown for comparison. Long-term quantitative data are not available, but as Bay Area population grows over the 50-year project window, site usage and recreational traffic on the site are also expected to increase, given the substantial proportion of site users who are Bay Area residents (close to 70 percent). Thus, the following analysis is probably conservative with regard to the severity of parking impacts.

[1] Note that this analysis focuses on effects of parking availability/configuration on visitor experience. For a detailed discussion that focuses specifically on parking and traffic-related issues, see Section 4.3.4.2 (*Traffic and Circulation*).

Table 4.3.4.1-3. Summary of Projected Parking Surpluses and Shortfalls under Public Access Alternatives

Public Access Alternative	# Spaces Provided	Summer Peak Season		Shoulder Seasons		Winter Off-Peak Season	
		Weekday (Demand= 159)	Weekend (Demand= 201)	Weekday (Demand= 115)	Weekend (Demand= 160)	Weekday (Demand= 30)	Weekend (Demand= 120)
A (No Action)	175	+16	**–26**	+60	+15	+145	+55
B1	50	**–109**	**–151**	**–65**	**–110**	+20	**–70**
B2	145	**–14**	**–56**	+30	**–15**	+115	+25
B3	175	+16	**–26**	+60	+15	+145	+55
B4	175	+16	**–26**	+60	+15	+145	+55
B5	200	+41	**–1**	+85	+40	+170	+80
C	118	**–41**	**–83**	+3	**–42**	+88	**–2**

Source: DKS Associates 2006.

Note that under all of the action alternatives there would be at least a minor parking shortfall on peak-season weekends, when site use and parking demand are highest. Alternative B5, which would provide 25 more spaces than are now available, would come closest to accommodating projected peak parking needs, with only a minimal shortfall. Similarly, only Alternatives B3, B4, and B5 are expected to meet or exceed peak-season weekday demand. Alternatives B1, B2, and C would likely also show substantial deficits during the shoulder and off-seasons; of the action alternatives, only B3, B4, and B5 would meet existing shoulder and off-season demand.

One effect of reduced parking availability under Alternatives B1, B2, and C would be increased queuing, as recreational visitors wait for spaces to become available. Parking queues would be expected to form at any time when demand exceeds availability (DKS Associates 2006). As shown in Table 4.3.4.1-3 above, this would be expected to occur most frequently (peak and shoulder season weekdays and weekends, off-season weekends) under Alternative B1, which would provide only 50 parking spaces. It would also be a common occurrence (peak season weekdays and weekends, shoulder and off-season weekends) under Alternative C, which would provide 118 spaces. Queuing would be a somewhat less frequent occurrence (peak season weekdays and weekends, shoulder season weekends) under Alternative B2, which would provide 145 parking spaces, and would be expected only on peak-season weekend days under Alternatives B3, B4, and B5, which would provide 175, 175, and 200 spaces respectively.

Table 4.3.4.1-4 summarizes anticipated parking queue lengths when parking demand exceeds supply. This table was based on parking utilization surveys conducted to identify maximum hourly vehicle arrival rates at Muir Beach, and

assumes that drivers would be unwilling to wait longer than 15 minutes for parking. The length of the parking queue (number of vehicles waiting) was calculated as:

vehicles arriving per minute x 15 minutes.

Table 4.3.4.1-4. Anticipated Formation of Parking Queues

		Peak Season	Shoulder Seasons	Off-Peak Season
Weekdays	Vehicle Arrivals per Hour	103	103	30
	Vehicle Arrivals per Minute	1.72	1.72	0.50
	Maximum # of Vehicles in Queue	**26**	**26**	**8**
Weekends	Vehicle Arrivals per Hour	122	88	124
	Vehicle Arrivals per Minute	2.03	1.47	2.07
	Maximum # of Vehicles Queue	**31**	**22**	**31**

Source: DKS Associates 2006.

Table 4.3.4.1-5 shows the maximum number of vehicles in queue under the various alternatives.

Table 4.3.4.1-5. Number of Vehicles in Queue under Public Access Alternatives

Public Access Alternative	Summer Peak Season		Shoulder Seasons		Winter Off-Peak Season	
	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend
A (No Action)	0	**31**	0	0	0	0
B1	**26**	**31**	**26**	**22**	0	**31**
B2	**26**	**31**	0	**22**	0	0
B3	0	**31**	0	0	0	0
B4	0	**31**	0	0	0	0
B5	0	**31**	0	0	0	0
C	**26**	**31**	0	**22**	0	**31**

Source: DKS Associates 2006, Appendix D

As shown in Table 4.3.4.1-5, as many as 26–31 vehicles could be waiting for parking at any given time on peak-season weekend days. Variability during the

off-season is greater because of the greater disparity between weekday and weekend demand, but the worst case for the off-season is similar. Although some vehicles might wait within the parking lot, for the purposes of this analysis, a worst-case scenario was assumed in which queues form at the parking lot entrance, regardless of the size of the parking lot (DKS Associates 2006). Queues might move more quickly under the alternatives with more parking spaces available, but this is difficult to predict in a meaningful way, because it would depend on the length of individual visitors' stays on any given day.

Visitor reactions to changes in parking availability are likely to be complex. The 2003 user survey explored reactions to several possible parking modifications, as summarized in Table 4.3.4.1-6.

Table 4.3.4.1-6. Survey Respondents' Reactions to Potential Changes in Parking Configuration

Suggested Modification	# of Respondents	Strongly Oppose	Oppose	Neutral	Support	Strongly Support
Reduce size of existing lot at beach and provide shuttle service	353	21%	26%	24%	21%	9%
Reduce size of existing lot at beach and provide overflow lot up to 0.5 mile away	354	17%	16%	22%	33%	12%
Reconfigure existing lot to minimize its environmental impacts	354	3%	6%	20%	44%	28%
Increase size and modify configuration of existing lot	336	21%	22%	33%	17%	7%
Move all parking to a lot up to 0.5 mile away	349	27%	23%	26%	16%	8%

Source: Manning and Budruk 2003

As shown in Table 4.3.4.1-6, one-quarter to one-third of respondents identified themselves as neutral on the range of parking modifications presented in the 2003 user survey. A sizable majority (72 percent) expressed support for reconfiguring the existing lot to maintain its capacity while reducing environmental impacts. Many (50 percent) opposed moving all parking away from the beach, but sentiment was divided regarding reduced parking capacity at the beach combined with an overflow lot at another location (45 percent in favor, 33 percent opposed), and reduced parking capacity at the beach combined with shuttle service to another location (30 percent in favor, 47 percent opposed). More respondents opposed increasing the size of the existing lot than supported this approach (43 percent opposed, 24 percent in favor). Overall, users appear support the general idea of reducing environmental impacts and reducing parking at the beach, as long as some beachside parking continues to be available. However, there was some support for increasing parking at the beach.

It is difficult to assess how survey respondents' responses to the hypothetical parking scenarios posed in the 2003 user survey would correlate with actual user experience following implementation of the Public Access Alternatives. Even with a general level of support for parking reconfiguration, reduced parking availability and increased queuing and wait times would be frustrating for all visitors who access the site by car, local and out-of-town alike. The only visitor populations likely to remain relatively unaffected would be equestrians and the relatively small number adjacent residents who access the site on foot or by bicycle, although these users might also be disturbed or annoyed by long parking queues. In addition, in extreme situations, most likely during the peak season, some visitors would be likely to park illegally on the shoulders of access roadways, in the adjacent residential community, or on other available flat space. Related impacts on safety and community relations are discussed separately below.

Public Access Alternative A: Negligible. The No Action Alternative would not alter parking location or availability or the nature of public access. There would be no change in these aspects of the visitor experience by comparison with existing conditions. There would be no impact.

Public Access Alternative B1: Major Adverse. Reducing the capacity of the parking lot from 175 to 50 vehicles would substantially reduce the public's ability to access Muir Beach recreation resources at all times except off-season weekdays. Some users would likely choose to use other area facilities. Parking queues would likely be frustrating to those who choose to remain, and could be particularly distressing for local residents, who might experience a sense of invasion. Illegal parking could also be a concern. This represents a significant impact on recreational opportunities and on the quality of the visitor experience. If Muir Beach is included in the Caltrans ITS system at some time in the future (see additional discussion in Section 4.3.4.2, *Traffic and Circulation*), these issues would probably be alleviated to some extent, but would likely remain significant.

Public Access Alternative B2: Minor Adverse. The capacity of the existing parking lot would be reduced from 175 to 145 vehicles. This would reduce the accessibility of Muir Beach facilities during the peak season and on shoulder season weekends, but overall effects would be substantially less than those anticipated under Alternative B1. Because the parking lot would remain in its existing location, the effects of Alternative B2 on visitors' experience as they access the beach and other facilities from the parking lot would be negligible. Impacts would be less than significant.

Public Access Alternative B3: Negligible. Parking lot capacity would be unchanged under this alternative, and there would be no change in aspects of the visitor experience related to parking availability. Site accessibility, and visitor experience related to parking and accessing the beach and other facilities, would be similarly unaffected. There would be no impact.

Public Access Alternative B4: Minor Beneficial. Parking lot capacity would be unchanged under this alternative; however, the visitor experience would be improved somewhat by providing stacking for 15 cars within the parking lot, which would reduce the length of the queue on Pacific Way and related conflicts in that location. Site accessibility, and visitor experience related to parking and accessing the beach and other facilities, would be similarly unaffected. Impacts are minor beneficial.

Public Access Alternative B5: Minor Beneficial. Parking lot capacity would increase from 175 to 200 vehicles, resulting in an overall beneficial effect on visitors' parking experience and ability to access Muir Beach facilities during the peak times. Because the parking lot would remain in essentially its existing location, the effects of Alternative B5 specific to visitors' experience as they access the beach and other facilities from the parking lot would be negligible. Impacts would be beneficial.

Public Access Alternative C: Moderate Adverse. The capacity of the existing parking lot would be reduced from 175 to 118 vehicles, reducing public access to Muir Beach facilities at all times during the peak season and on shoulder and off-season weekends. Reduced parking availability would likely increase frustration and visitor disturbance related to queuing. This impact is identified as significant, and no feasible mitigation has been identified.

Alternative C would also relocate the parking lot farther from the beach, requiring a 0.5-mile walk to access the beach, which might be a concern for some visitors. However, disabled-accessible parking would be provided at the beach, ensuring site access for those unable to make the walk from the remote lot. A beachside drop-off area would also be provided to allow visitors to avoid carrying heavy picnic baskets, beach chairs, and other awkward items from the remote lot. The new beach access trail would be within an alder grove along the creek/lagoon, and thus would offer a pleasant natural environment, welcoming visitors to the park and allowing them to transition gradually from the highway to the beach. Many visitors are expected to experience this as a benefit. These visitors may also appreciate the relocation of the parking lot to a site removed from the beach, so parking and car activity are less intrusive on the beach environment. On balance, this impact is considered less than significant, and may represent a benefit for some visitors.

Impact REC-P3: Effects of Visitor Amenities on Recreational Opportunities and Visitor Experience (Long-Term, Years 5 and 50)

In addition to the parking reconfigurations discussed above, all of the Public Access Alternatives would also include the following alterations to visitor amenities at Muir Beach.

- Relocation of existing picnic area and restroom facilities to the west. The new picnic area would be large enough to accommodate about 10 picnic tables and would be equipped with grills to encourage safe cooking practices. Note that additional restroom facilities would be provided at the alder grove under Alternative C.

- Pedestrian access paralleling Pacific Way from Hwy 1 to the beach parking lot or drop-off area, and a new pedestrian boardwalk/bridge from the lot to the beach.
- An emergency access route from Pacific Way to the south boundary of the restoration area. The new emergency access would follow the alignment of the existing Green Gulch Farm access road, and would replace the levee road for access to the Coastal Trail and Coyote Ridge.
- New interpretive displays and possibly also an interpretive blind/overlook for birding.

The relocated picnic area and restroom facilities would ensure that the site's existing capacity to support picnics and other informal gatherings is preserved. New facilities would be pleasant and inviting and are expected to improve the visitor experience, although they would not add new recreational opportunities. Almost half of the respondents in the 2003 user survey identified restroom cleanliness as an issue (Manning and Budruk 2003), and the new facilities would help to address this concern.

The new access routes would also improve or maintain the visitor experience but would not add recreational opportunities. The new pedestrian access route from Hwy 1 would also improve the visitor experience. Pedestrians currently walk along Pacific Way, and a dedicated pedestrian trail would offer more pleasant, relaxing, and safer access. The new boardwalk to the beach could provide varying vistas for viewers depending upon its location, but would provide an overall similar level of benefit to visitors related to accessing the beach. The new emergency access route will not only ensure efficient access by emergency vehicles but will also maintain visitors' existing ability to access the Coastal Trail and Coyote Ridge area from Muir Beach.

New interpretive displays would help to increase visitor understanding of the diverse natural resources at Muir Beach/Big Lagoon, and would provide an outstanding opportunity for outreach and education about the restoration process. If the new birding blind is built, it would improve opportunities for visitors to observe birds and wildlife using the site's restored habitats. The new displays and the new blind, if built, would both address the desire for additional educational opportunities expressed by the 2003 user survey respondents (see Manning and Budruk 2003).

Public Access Alternative A: Negligible. Under the No Action Alternative, visitor amenities would not be modified. There would be no impact.

Public Access Alternatives B1–B5, C: Minor Beneficial. The relocated and new facilities provided under the action alternatives would ensure that all existing uses are continued at the same or slightly increased levels, and new facilities would be pleasant and inviting, representing a benefit for users. New interpretive displays and pedestrian access would also represent benefits. Impacts would be beneficial (see previous impact for analysis of effects of parking lot siting on visitor experience).

Public Access Alternatives—Effects on Safety

Impact REC-P4: Short-Term Effects on Visitor Safety During Public Access Construction (Short-Term, Year 0)

As discussed above for the restoration alternatives, construction required to reconfigure public access would also have some potential to pose a safety risk to visitors, if they are not excluded from active work sites and equipment travel routes. Some level of risks could affect all uses, with the potential for additional risk specific to equestrians. Construction can generate loud noises, and horses are highly sensitive to loud noises; loud sudden noises in particular can cause them to shy, bolt, or otherwise behave unpredictably. Inexperienced riders can be at particular risk of injury in such situations, and horses can also injure themselves when frightened.

Note that since no construction would take place under the No Action Alternative (Alternative A), the No Action Alternative would have no potential to change visitor safety conditions.

Public Access Alternative A: Negligible. No construction activity would take place. Thus, there would be no impact.

Public Access Alternatives B1–B5, C: Moderate Adverse. Safety risks to visitors are potentially significant, but could be addressed by implementing mitigation measures REC-MM-1, creating construction exclusion areas and REC-MM-2, implementing horse and equestrian safety measures. With these measures in place, construction-related impacts on visitor safety would be less than significant.

Public Access Alternatives—Effects on Community Relationships

Impact REC-P5: Effects of Parking Lot Configuration and Siting on Community Relationships (Long-Term, Years 5 and 50)

Under the No Action Alternative (Alternative A), parking and public access would remain unaltered. Pedestrians would continue to use Pacific Way for beach access from Hwy 1, competing with cars for road space. Visitors would likely also continue to park illegally along Pacific Way during peak demand times.

Decreasing parking lot size by comparison with the existing 175-car capacity would increase the number and duration of periods throughout the year when capacity would be exceeded. Overflow visitors unwilling to wait in a parking queue for spaces to become available in the beach lot would likely search for alternative parking in the Muir Beach community, in the Pelican Inn parking lot, and/or along Pacific Way. All of these options would be a concern for area residents, Pelican Inn guests, and other visitors, and could have substantial impacts on the relationship between NPS and the local community, and between visitors and local residents.

Public Access Alternative A: Negligible. The parking lot would not be modified under the No Action Alternative. Impacts would be less than significant.

Public Access Alternative B1: Major Adverse. With parking lot capacity decreased from 175 spaces to 50 spaces, parking lot capacity could be exceeded at almost any time throughout the year (peak and shoulder season weekdays and weekends, off-season weekends) under Alternative B (see Table 4.3.4.1-3). Overflow visitors expected to seek parking elsewhere, as described above. Impacts would be significant. No feasible mitigation has been identified.

Public Access Alternative B2: Moderate Adverse. With parking lot capacity decreased slightly, from 175 to 145 spaces, lot capacity is likely to be exceeded only during the peak season (weekdays and weekends) and on shoulder season weekends (see Table 4.3.4.1-3). Overflow into other less acceptable parking would thus occur primarily during the peak season. However, effects could still be readily apparent and a substantial concern for residents and visitors. Impacts would be significant. No feasible mitigation has been identified.

Public Access Alternative B3: Negligible. Alternative B3 would not modify parking lot capacity or siting, so overflow conditions are not expected to change under this alternative. There would be no impact.

Public Access Alternative B4: Minor Beneficial. Parking lot capacity would not be modified under Alternative B4, but the lot would be rotated parallel to Pacific Way and a stacking area would be added to accommodate the parking queue. Overflow conditions would not change unless visitors park illegally in the stacking area. Any illegal parking in the stacking area would alleviate effects on the Muir Beach community and Pelican Inn, but, because it is counter to the purpose of the stacking area, would not represent a sustainable benefit for the local community, or for park-community relationships. Impacts would be less than significant on balance.

Public Access Alternative B5: Moderate Beneficial. With parking lot capacity increased to 200 spaces, capacity is unlikely to be exceeded even during the peak season, when the maximum projected weekend shortfall is 1 space (see Table 4.3.4.1-3). This increase in parking availability would help to alleviate existing overflow into the community, the Pelican Inn lot, and illegal parking along Pacific Way, with the potential for marked benefits to community relationships. Impacts would be beneficial.

Public Access Alternative C: Minor Beneficial. Alternative C would reduce parking lot capacity from 175 to 118 spaces, making overflow likely during the peak season and on shoulder and off-season weekends (see Table 4.3.4.1-3). Parking impacts on the community and Pelican Inn would be likely to increase, representing a significant impact. However, relocating the parking lot to the alder grove area would make it less conspicuous to the community, reducing noise and visual disturbance effects on adjacent residents and Pelican Inn guests for those who are parking legally. On balance, this alternative is evaluated as offering a minor benefit for community relations. Impacts would be beneficial.

Bridge Alternatives

Table 4.3.4.1-7 summarizes the potential impacts of Bridge Alternatives to recreational and visitor experience in the study area. The Bridge Alternatives are described in Chapter 2.

Table 4.3.4.1-7. Potential Recreational Use Impacts from Bridge Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	Mitigation Measure
REC-B1: Effects on Visitor Experience from the Bridge Alternatives	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	

Impact REC-B1: Effects on Visitor Experience from the Bridge Alternatives (Long-Term, Years 5 and 50)

The proposed new bridge would not alter recreational opportunities at Muir Beach, but all of the action alternatives would substantially improve the convenience and safety of visitor access to the site by replacing the existing one-lane structure with a wider and more attractive two-lane structure. Overall traffic flow and safety benefits (see Section 4.3.4.2, *Traffic and Circulation* for detailed analysis) are evaluated as representing a minor to moderate level of benefit for the recreational experience. As discussed in Section 4.3.4.3, *Aesthetics*, the new bridge—like the existing structure—would represent an intrusive built element in a largely natural view, and would be larger and thus more apparent than the existing bridge. However, it would be designed for consistency with the landscape and the overall rural/rustic appearance of other facilities on the site. Consequently, its aesthetic effect, and any resulting aesthetic effect on the visitor experience, would be minor and outweighed on balance by the positive effect of improved traffic flow, access, and safety. From the perspective of the visitor experience, differences between the Bridge Alternatives would be negligible. Impacts would be beneficial under all action alternatives.

Bridge Alternative BR0: Negligible. No new bridge would be constructed.

Bridge Alternatives BR1-BR4: Moderate Beneficial.

Fill Disposal Alternatives

Table 4.3.4.1-8 summarizes the potential impacts of Fill Disposal Alternatives to recreation and visitor experience in the study area. Fill disposal activities would be restricted to portions of the construction window, and would be managed to minimize or avoid impacts on access, safety, and community relationships. Consequently, analysis focused on the effects of fill disposal on the visitor experience. The Fill Disposal Alternatives are described in Chapter 2. Detailed analysis follows.

Table 4.3.4.1-8. Potential Recreational Use Impacts from Fill Disposal Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail*	Mitigation Measure
REC-F1: Changes in Visitor Experience from Truck Trips and Fill Disposal Activities	Negligible	Negligible	Negligible	Negligible	Negligible	
REC-F2: Changes in Visitor Experience from Altered Fill Disposal Site Characteristics	Moderate Beneficial	Negligible	Moderate Beneficial	Negligible	Negligible	

Note:

* The analysis of the two trail alternatives only considers the effects of hauling the fill to the sites. For the coastal trail, impacts of using the fill to recontour the trail are also considered.

Impact REC-F1: Changes in Visitor Experience from Truck Trips and Fill Disposal Activities (Short-Term, Year 0)

Excavated materials not reused on-site as fill would be disposed or reused at one of five possible locations (see Chapter 2 and Figure 2-22): at the Unused Reservoir Pit adjacent to the Coastal Trail north of the Muir Beach overlook; at the Banducci field; at the Hamilton Air Force Base wetland restoration site in Novato; along the Dias Ridge trail; or along the Coastal Trail. The Banducci Field and Hamilton wetland restoration sites do not currently support recreational use, and, as discussed in Section 4.3.4.2, *Traffic and Circulation*, haulage could be managed to minimize effects on recreational access and the visitor experience. Fill could also be placed along the Dias Ridge Trail and/or the Coastal Trail to support separate recontouring projects that NPS has identified as necessary. Recontouring along either trail would require closure for the duration of construction, potentially representing a short-term adverse effect on recreation.

All Alternatives: Negligible. As discussed above, fill haulage and disposal activities could be managed to minimize short-term effects on the visitor experience at Muir Beach and the disposal sites. With mitigation identified in Section 4.3.4.2, *Traffic and Circulation*, in place, impacts would be less than significant.

Impact REC-F2: REC-F2: Changes in Visitor Experience from Altered Fill Disposal Site Characteristics (Long-Term, Years 5 and 50)

Unused Reservoir Pit: Moderate Beneficial. Over the long term, use of the Unused Reservoir Pit offers potential benefits for the visitor experience. The Unused Reservoir Pit is visible from the Coastal Trail, and currently detracts from views from the trail; once filled and revegetated, it would be considerably more natural in appearance and much more visually appealing, representing a benefit for trail users.

Upper Banducci Field: Negligible. This site is not used for recreational purposes.

Hamilton Wetland Restoration Site: Moderate Beneficial. Use of fill would support beneficial reuse of fill materials. In addition, once restored, the Hamilton site would offer recreation such as walking/hiking, birding, and nature-watching, so reuse of fill to support restoration at this site would also represent a longer-term benefit to recreational opportunities and the visitor experience in the region.).

Dias Ridge Trail, Coastal Trail: Negligible. Over the longer term, recontouring would benefit the visitor experience. However, insufficient information is available at this time to assess effects in detail, and further analysis under both NEPA and CEQA would be required if either of these alternatives is selected.

Mitigation Measures

Mitigation Measure REC-MM-1: Construction Exclusion Areas

During construction, NPS will ensure that all active construction, staging, and stockpile areas are fenced to render them inaccessible to the public. Fencing will be a minimum of 8 feet high and will consist of chainlink or another equally secure material. To minimize visual intrusiveness of fencing, it will be designed and installed to blend into the surrounds as much as possible. All construction, staging, and stockpile access will be gated and gates will be kept locked except when in use. Signs will be conspicuously posted to inform the public about the need for caution. If it is necessary for construction vehicles or heavy equipment to travel outside the fenced construction area, flaggers, traffic cones and/or high-visibility temporary construction fencing will be used to delineate construction equipment travel routes and alert the public to the presence of heavy equipment and/or slow-moving vehicles.

Mitigation Measure REC-MM-2: Horse and Equestrian Safety Measures

In addition to, or in combination with, the general informational noticing for the project, NPS will ensure that public notices addressing horse and equestrian safety are posted on the NPS/GGNRA website, at all area equestrian facilities, at trailheads that serve equestrians, and on fencing at active construction sites. Notices will alert the public to the location, nature, and duration of construction activities and the potential for construction noise to frighten horses. Riders will be cautioned regarding the risk of horses shying and/or bolting, the risk of injury, and the risk of horses injuring themselves. Notices will provide information on alternate trail routes and other area equestrian facilities for use during construction, and will include a name, phone number, and e-mail address for an NPS staff member the public can contact with questions or concerns. Website and equestrian facility notices will be posted at least a month prior to construction each year, and will remain up throughout the construction season. Notices at the active construction site will be posted as soon as possible after exclusion fencing (see REC-MM-1) is erected.

Exhibit 2: Final Environmental Impact Statement

4.3.4.2 Traffic and Circulation

Guiding Regulations and Policies

In general, traffic planning in California is guided by standards set at the state level by Caltrans, and more locally by the policies and ordinances adopted by city and county jurisdictions. Because Muir Beach is an NPS facility, traffic planning for the proposed project site is also governed by NPS management policies, and by NPS planning documents for the GGNRA. The following sections summarize key guidelines.

NPS Management Policies

NPS has a long-term policy of early participation in transportation studies and advance planning, and a tradition of close partnership with other federal agencies; tribal, state, and local governments; and other stakeholders. In partnership with these entities, NPS's intent is to "seek reasonable access to parks, and connections to external transportation systems" (National Park Service 2006a).

The Park Facilities section of NPS's Management Policies document identifies the location and design of transportation systems as an important aspect of the visitor experience at national parks. Transportation systems also represent an important control on the extent and nature of impacts to natural resources as a result of the human presence in parklands. NPS therefore requires a comprehensive consideration of alternatives when transportation systems are designed and built (National Park Service 2006a). In addition to requiring stringent analysis of the need for new transportation infrastructure, facilities, or components, NPS Management Policies (National Park Service 2006a) require that transportation improvements and new transportation construction must be

- based on a comprehensive, multi-disciplinary approach consistent with the park's general management plan and asset management plan;
- appropriate to site conditions, designed with extreme sensitivity to the landscape, and necessary for park management and/or visitor use and enjoyment;
- designed to avoid unacceptable impacts to natural and cultural resources, and to minimize or mitigate impacts that cannot be avoided;
- designed to reduce traffic congestion, noise, air pollution, and adverse effects on park resources and values; consistent with federal, state, and local air pollution control plans or regulations;
- consistent with the visitor carrying capacity of the areas served;
- environmentally, operationally, and financially sustainable; and
- accessible to all people, including those with disabilities.

Finally, new transportation construction must enhance the visitor experience by offering new or improved interpretive or recreational opportunities, or improving access (National Park Service 2006a).

Marin Countywide Plan

Traffic and transportation planning are among the issues the State of California requires local jurisdictions to address in their general plans. Consistent with this requirement, the Marin Countywide Plan, which is currently undergoing revision, identifies a vision for traffic and transportation planning throughout the County. Highlights include a call for a multi-modal system that integrates bus, rail, ferry, bicycle, and pedestrian travel to supplement and supplant automobile use, with the goal of reducing traffic congestion and improving air quality (County of Marin 2004b). However, the draft Plan acknowledges that automobile travel will likely remain a dominant mode of transport for the foreseeable future and that a County-wide vehicle LOS standard is needed. It identifies the purpose of establishing a vehicle LOS standard as threefold:

1. ensuring conformity with policies of the County's Congestion Management Program;
2. enabling the County to prioritize the need for transportation system improvements and allocate funding wisely; and
3. identifying appropriate locations for new development, in light of the County's expectation that development will contribute to meeting LOS standards by providing transportation improvements, paying fees that support such improvements, and/or participating in programs to manage and control travel demand.

Recognizing the importance of car travel and the difficulty of alleviating congestion on heavily traveled routes, the propose Plans identifies LOS D as the minimum acceptable peak-hour condition on urban and suburban arterial routes, and LOS E as the minimum acceptable condition on freeways and rural expressways.

The adopted 1994 Countywide Plan identifies LOS D or better as the goal for all unincorporated streets and Hwy 1. US-101 has an adopted goal of LOS E or F, depending on location in the County.

Redwood Creek Watershed Vision for the Future

As discussed in Section 4.3.4.1, *Recreation and Visitor Experience*, a number of local agencies recently undertook a year-long process to identify a vision for long-term management of the watershed and its resources. The visioning process was conceived as the first step in developing a more concrete watershed management framework. Agency partners in the visioning process included NPS, the California Department of Parks and Recreation and Department of Fish and Game, the Marin Municipal Water District, the County of Marin, and the Muir Beach Community Services District (Redwood Creek Watershed Vision Team 2006). The process also included extensive public outreach (National Park Service 2003).

The *Redwood Creek Watershed Vision for the Future* encompasses descriptions of "desired future conditions" for a variety of aspects of watershed function and use, including several that are relevant to traffic planning, listed below (National Park Service 2003), as follows:

- People visit the watershed in a manner that minimizes traffic congestion and its related negative impacts to communities and watershed resources.
- Watershed visitor traffic, parking, and recreation have minimal impacts to local communities.
- Emergency services are provided throughout the watershed.

Study Area

The study area for traffic and circulation impacts includes the project site and three nearby intersections (Shoreline Highway and Muir Woods Road, Shoreline Highway and Pacific Way, and Shoreline Highway and Panoramic Highway). Impacts of fill disposal at the Hamilton Air Force base also considered portions of Hwy 1 south of Panoramic Highway, and US-101 between Tam Junction and Novato.

Analysis Thresholds

Effects on traffic and circulation were evaluated as *negligible*, *minor*, *moderate*, or *major*, based on the thresholds described below. The thresholds for each effect category were developed based on NPS management policies for transportation and the visitor experience, in light of the prevailing standard of care for traffic engineering.

- **Negligible:** Effects on level of service would be barely perceptible, or would be restricted to a very limited area. No applicable level of service standards would be exceeded. Emergency access would not be affected. There would be no identifiable effect on automobile, pedestrian, bicyclist, or equestrian safety.
- **Minor:** Effects on level of service would be noticeable but would be limited in severity and/or areal extent. No applicable level of service standards would be exceeded. Parking supply would be adequate for demand, except during periods of maximum demand (i.e., weekends during the peak season). Emergency access would not be affected. Effects on automobile, pedestrian, bicyclist, and/or equestrian safety could occur but would be minimal.
- **Moderate:** Effects on level of service would be very noticeable or would affect a wide area. Applicable level of service standards could be exceeded. Existing parking insufficiency would be worsened somewhat, particularly during peak demand periods. Emergency access would be affected. Automobile, pedestrian, bicyclist, and/or equestrian safety could be compromised.

- **Major:** Level of service would be substantially degraded, or parking supply would be substantially exceeded. Applicable level of service standards would be exceeded. Emergency access would be substantially affected. Automobile, pedestrian, bicyclist, and/or equestrian safety is likely be compromised at least intermittently.

Methods and Assumptions

Construction Impacts

Impacts for construction mobilization, deliveries, construction worker trips, parking, and onsite construction traffic were evaluated qualitatively considering the extent and duration of construction.

Fill Hauling Analysis

The number of haul trips were estimated based on the use of either 10-CY or 20-CY capacity trucks, given the total volume of fill for the alternative in question. This information was used in combination with (1) the anticipated duration of fill hauling for the activities associated with the alternative and (2) the haul route, to determine impacts.

Parking Demand Analysis

Parking lot size was compared to weekday and weekend demand during the peak, shoulder, and off-peak seasons to determine the shortage or surplus of parking under the various Public Access Alternatives.

LOS and Intersection Delay

Intersection analysis was conducted to determine existing and projected level of service at the following three intersections:

- Hwy 1 and Muir Wood Road,
- Hwy 1 and Pacific Way, and
- Hwy 1 and Panoramic Highway.

Intersection analysis was evaluated using the Highway Capacity Manual (Transportation Research Board 2000), as applied by the TRAFFIX software program.

In order to evaluate the change in traffic conditions associated the Public Access Alternatives, it was assumed that 25 percent of the vehicles not able to find a parking space would remain in the parking lot while 75 percent of the vehicles would exit and travel to an alternate site. Excess vehicles were re-routed at the intersection of Shoreline Highway and Pacific Way, assuming a 75 percent northbound and 25 percent southbound split at Shoreline Highway. This distribution is based on existing travel patterns and the locations of complementary land uses. The number of vehicles traveling northbound and/or southbound were then split assuming a 50-50 percent split at the intersection of

Shoreline Highway and Muir Woods and Shoreline Highway and Panoramic Highway.

Because no data were available on the extent of illegal parking at the site during periods when parking capacity is exceeded, modeling assumed that vehicles accessing the parking lot when the lot was full would either wait for a parking space or leave the site.

Queuing Analysis

Based on parking utilization surveys conducted at the Muir Beach parking lot during the peak and shoulder seasons, a maximum hourly arrival rate (in vehicles) was calculated for each season except for the off-season. The maximum parking demand estimated for the off-peak season during a weekday and weekend period was assumed to be the same as the maximum arrival rate.

Where the parking demand exceeded parking supply, queuing was assumed to occur.

Effects on Safety and Accessibility

Effects on safety and accessibility were evaluated qualitatively based on the conclusions of the analyses above.

Restoration Alternatives

Table 4.3.4.2-1 summarizes the potential impacts of the Restoration Alternatives on traffic and circulation in the study area. The Restoration Alternatives are described in detail in Chapter 2, and a complete discussion of each impact follows the table.

Table 4.3.4.2-1. Potential Traffic and Circulation Impacts from Restoration Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				
Impact	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	Mitigation Measure
TC-R1: Effects of Construction Mobilization and Materials Deliveries	Negligible	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	TC-MM-1: Construction Traffic Management Plan
TC-R2: Effects of Construction Worker Trips to and from Site	Negligible	Negligible	Negligible	Negligible	
TC-R3: Effects of Construction Worker Parking	Negligible	Negligible	Negligible	Negligible	

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
TC-R4: Effects of Truck Trips Associated with Fill Disposal	Negligible	**Moderate Adverse/** Minor Adverse	**Major Adverse/ Moderate Adverse**	**Major Adverse/ Moderate Adverse**	TC-MM-1: Construction Traffic Management Plan

Impact TC-R1: Effects of Construction Mobilization and Materials Deliveries (Individual, Short-Term, Year 0)

Under the No Action Alternative (Alternative 1), no active modification of the site's natural or built features is planned. Periodic maintenance of the channel and recreational facilities would continue to be necessary, but such activities would probably be similar in nature and extent to those that have taken place in recent years. Because no construction would take place under Alternative 1, and dredging and other maintenance would continue essentially unchanged from recent practice, Alternative 1 would not result in construction-related effects traffic, circulation, or visitor access via any modality.

By contrast, all of the action alternatives would entail substantial earthwork to relocate the Redwood Creek channel; construct a new drainage swale in the upper pasture area; and enhance backbeach lagoon, channel, and dune habitats. All of the action alternatives would also remove the levee road, levee, and associated utilities; the Muir Beach Tavern ruins; and hardscape elements in the Redwood Creek channel. Invasive exotic vegetation would also be removed. In addition, over the short term, dredging would continue to be necessary until the restored channel is fully integrated and functional, although the extent and nature of activities would probably not change materially from recent practice.

The general nature of construction activities—and, thus, construction traffic—would be similar under all three action alternatives; the principal difference between the alternatives would be the duration of construction. Under Alternative 2, construction would take place during the summer months of three consecutive years. Under Alternatives 3 and 4, which propose more extensive construction, an additional summer would be required. All alternatives would also involve some construction traffic associated with interim flood control activities.

Heavy construction equipment would be needed for all three action alternatives, and would be delivered to the work site on trailers and/or flatbed trucks. Haul trucks (flatbeds and/or dump trucks) would be needed to deliver materials to the site, and dump trucks would be used to offhaul excavated materials for reuse or disposal elsewhere. Since the only access to the site is via narrow, winding roads that are difficult for long–wheelbase vehicles to negotiate, construction mobilization (equipment delivery) and delivery of materials is likely to disrupt traffic on Hwy 1 and Pacific Way, increasing congestion, delays, and driver frustration. The presence of slow-moving vehicles that are ill-suited to these

narrow, winding roads is also likely to present a hazard for other road users, including motorists, pedestrians, and bicyclists.

Restoration Alternative 1: Negligible. No construction-related effect on traffic or circulation is anticipated under the No Action Alternative.

Restoration Alternative 2: Minor Adverse. Effects would be limited to the summer season of three consecutive years, in addition to truck traffic associated with the interim flood reduction measures. LOS standards could be temporarily exceeded and traveler safety could be compromised for parts of each year's construction window, but exceedances would be localized and of comparatively short duration. Mitigation measure TC-MM-1 (Construction Traffic Management Plan) is recommended to minimize impacts.

Restoration Alternatives 3, 4: Minor Adverse. Effects would be similar to those described for Alternative 2, but construction would be more extensive, and would continue for an additional summer. Because more equipment and materials would likely be required and disruption would continue for an additional peak season, the overall level of effect would be greater. However, impacts would still be localized and of comparatively short duration. Mitigation measure TC-MM-1 (Construction Traffic Management Plan) is recommended to minimize impacts.

Impact TC-R2: Effects of Construction Worker Trips to and from Site (Individual, Short-Term, Year 0)

Under the No Action Alternative, there would be no need for additional worker access to site.

Under the three action alternatives, construction workers would need to access the work site, which would add vehicle traffic to area roadways, probably during morning and evening peak hours. Based on the anticipated number of workers (between five and 27, depending on the construction phase), the number of additional vehicle trips generated by construction would be quite small, even if each worker drove his or her own vehicle and traveled alone. Thus, even the maximum number of additional trips likely to result from construction (27 round trips per day) is considered unlikely to result in a noticeable change in traffic flow or intersection LOS on regional access routes, including Hwy 1.

Effects on Pacific Way and other local routes could be more noticeable but would be buffered to some extent by construction timing—workers would be likely to arrive for work early in the morning, before most visitors reach the site. Moreover, worker traffic approaching the worst-case scenario of 27 round trips per day—the only phase of construction likely to result in noticeable impacts to Pacific Way traffic or LOS at the Pacific Way–Hwy 1 intersection—would be confined to portions of each year's construction window. If workers park offsite and shuttle to the work area, as discussed in Impact TC-R3 below, effects on Pacific Way traffic and LOS at the Pacific Way–Hwy 1 intersection would be essentially imperceptible.

Restoration Alternative 1: Negligible. No additional workers would access the site under the No Action Alternative.

Restoration Alternative 2, 3, 4: Negligible. Effects on regional traffic flow and intersection LOS are not expected to be noticeable under any of the action alternatives. Effects on traffic along Pacific Way and LOS at the Pacific Way–Hwy 1 intersection could be more noticeable but would be limited in duration and are also considered negligible.

Impact TC-R3: Effects of Construction Worker Parking (Individual, Short-Term, Year 0)

Under the No Action Alternative, there would be no need for additional worker access to the site, and no effects on parking. Under the action alternatives, between 5 and 27 workers would need to be onsite, depending on the phase of construction. Adding a maximum of 27 vehicles to the existing parking lot would reduce parking availability to visitors by 15 percent of the lot's existing capacity.

Theoretically, this would be a concern when parking demand is within 15 percent of existing capacity—that is, at all times during the peak season and on shoulder season weekends (see Table 3.4.2-3). However, NPS plans to use a portion of the existing parking lot for construction staging (see related discussion in Impact TC-P1 below). This would reduce overall parking availability, but worker parking would be included in the construction staging area (see Impact TC-P1 below), so there no additional reduction in public parking would be needed to accommodate worker parking for restoration. Alternatively, NPS may choose to use offsite parking for workers and require them to shuttle to the work site. If a shuttle vehicle is used, it would also be accommodated in the staging area.

Restoration Alternative 1: Negligible. No additional worker parking would be needed under the No Action Alternative.

Restoration Alternative 2, 3, 4: Negligible. Impacts associated with construction worker parking for restoration activities would be minimal, because no additional reduction in parking availability (other than that needed to accommodate construction staging, discussed in Impact TC-P1 below) would be required.

Impact TC-R4: Effects of Truck Trips Associated with Fill Disposal (Individual, Short-Term, Year 0)

As discussed in Chapter 2 and Section 4.3.4.1, *Recreation and Visitor Experience*, any excavated materials not reused on-site as fill would be disposed or reused at one of five locations. The impacts of fill disposal at these locations are described under Impact TC-F2. This impact takes the conclusions of Impact TC-F2, and applies them to an overall conclusion for each Restoration Alternative, given the quantity of fill to be disposed of, the likely site(s) for fill disposal, and the related impacts of fill disposal at those sites.

Restoration Alternative 1: Negligible. Existing maintenance dredging would continue under the No Action Alternative, requiring disposal of a small volume

of material, but no restoration would take place, so disposal needs would not change materially.

Restoration Alternative 2: Moderate Adverse. Based on a fill disposal need of 24,750 CY (see Table 2-6), approximately 2,475 truck trips would be generated using standard 10-CY capacity trucks. Assuming that all excavation occurs during a single construction season, this represents 2,475 truck trips over a period of approximately 3 months or about 60 workdays, translating to approximately 40 truck trips per day or five truck trips per hour over an 8-hour workday. With larger 20-cy trucks, this could be halved, to approximately 20 truck trips per day or two to three truck trips per hour.

Using an alternate approach of assuming a maximum excavation production rate of 500 CY per day, the daily number of trips could be slightly larger: 50 per day/six to seven per hour using 10-CY capacity trucks, or 25 per day/three to four truck trips per hour using 20-CY capacity trucks. This would concentrate hauling to approximately 36 working days. In actuality, it is likely that fill hauling would be dispersed over the 3-year construction window.

This quantity of fill material could be disposed of locally at the Unused Reservoir Pit, the Upper Banducci Field, the Coastal Trail, or the Dias Ridge Trail. The impacts of disposal at these sites range from minor adverse to moderate adverse. Impacts are therefore considered to be moderate adverse and significant overall. Implementation of mitigation measure TC-MM-1 (Construction Traffic Management Plan) would reduce impacts below significance thresholds.

Restoration Alternative 3, 4: Major Adverse. As shown in Table 2-6, Alternatives 3 and 4 would require disposal of approximately 109,050 and 177,950 cubic yards of excavated materials respectively. Assuming a maximum excavation production rate of 500 CY per day, the daily number of trips would be 50 per day/six to seven per hour using 10-CY capacity trucks, or 25 per day/three to four truck trips per hour using 20-CY capacity trucks. Impacts would be similar to Restoration Alternative 2, but involve a much greater number of hauling days due to the larger amount of fill to be excavated. At the maximum excavation rate of 500 CY per day, Restoration Alternatives 3 and 4 would require approximately 200 and 350 days of hauling, respectively. It is likely that the number of days could even be higher than this, due to the fact that maximum excavation rates would not occur during every day of excavation.

Although some of the fill material could be disposed of locally within the watershed, a large quantity of fill material would require disposal at Hamilton AFB. Impacts of disposal at these sites range from minor adverse to major adverse; in the case of Hamilton AFB, which would receive the majority of material, impacts are major adverse. Impacts are considered major and significant overall. They would be addressed to the extent feasible by implementation of mitigation measure TC-MM-1 (Construction Traffic Management Plan), but would remain significant after mitigation.

A further discussion the impacts related to haul routes and traffic volumes based on fill disposal location and capacity is given in Impact TC-F1.

Public Access Alternatives

Table 4.3.4.2-2 summarizes the potential impacts of Public Access Alternatives on traffic and transportation in the study area. The Public Access Alternatives are described in Chapter 2.

Table 4.3.4.2-2. Potential Traffic and Circulation Impacts from the Public Access Alternatives

	Significance Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							
Impact	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	Mitigation Measure
TC-P1: Changes in Parking Availability During Construction	Negligible	**Major Adverse/ Moderate Adverse**	**Major Adverse/ Moderate Adverse**	**Major Adverse/ Moderate Adverse**	**Major Adverse/ Moderate Adverse**	**Major Adverse/ Moderate Adverse**	**Major Adverse/ Moderate Adverse**	TC-MM-1: Construction Traffic Management Plan
TC-P2: Effects of Construction Mobilization and Materials Deliveries	Negligible	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	TC-MM-1: Construction Traffic Management Plan
TC-P3: Effects of Construction Worker Trips to and from Site	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
TC-P4: Effects of Construction Worker Parking	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	
TC-P5: Effects of Truck Trips Associated with Fill Disposal	Negligible	Minor Adverse	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	TC-MM-1: Construction Traffic Management Plan

	Significance Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							
Impact	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	Mitigation Measure
TC-P6: Long-Term Changes in Parking Availability	Negligible	**Major Adverse**	Minor Adverse	Negligible	Negligible	Minor Beneficial	**Moderate Adverse**	
TC-P7: Effects of Parking Lot Size on Vehicle Queuing	Negligible	**Major Adverse**	Minor Adverse	Negligible	Minor Beneficial	Negligible	**Moderate Adverse**	
TC-P8: Effects of Parking Lot Size on LOS and Intersection Delay	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Negligible	Minor Adverse	
TC-P9: Long-Term Effects on Pedestrian, Equestrian, and Bicyclist Safety	Negligible	Minor Adverse	Minor Adverse	Minor Beneficial	Minor Beneficial	Moderate Beneficial	**Moderate Adverse**	
TC-P10: Long-Term Changes in Elderly and Disabled Accessibility	Negligible	Negligible	Negligible	Negligible	Minor Adverse	Negligible	Negligible	
TC-P11: Long-Term Effects on Emergency Access to Site	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
TC-P12: Consistency with NPS Policies Related to Parking	Negligible	Major Adverse	**Moderate Adverse**	Negligible	Negligible	Negligible	**Moderate Adverse**	

Impact TC-P1: Changes in Parking Availability During Construction (Individual, Short-Term, Year 0)

Under the various action alternatives, a portion of the existing lot would be used as a staging and storage area for construction equipment and materials, as well as construction worker parking, during most, if not all, of the construction duration. Some parking would continue to be provided at the beach lot; however, there would be a temporary (up to several month) period during construction of the new lot when no parking would be available. The effects of the reduction in available parking would be most acute during the periods of highest demand (refer to Table 3.4.2-3 for weekday and weekend demand by season). While the precise number of parking spaces that would be available during construction has not been determined, it is likely to be 100 spaces or less. As such, adequate parking supply would only be available during the weekdays of the off-peak season.

The reduction of available parking would be likely to displace visitors to other park facilities along Hwy 1, with corresponding increases in traffic at those locations. The lack of parking supply can also result in queues waiting for parking, or create additional local vehicle traffic as visitors "orbit" the site waiting for parking to become available. Finally, it would be likely to result in illegal parking on the shoulders of Pacific Way, Hwy 1, and other roadways in the adjacent residential area, as well as at the Pelican Inn and possibly Golden Gate Dairy. Assuming a worst-case scenario of 50 available parking spaces, the effects on delays and LOS would be similar to that of Parking Lot Alternative B1, which is shown on Tables 4.3.4.2-5 and 4.3.4.2-6. However, while delays would increase somewhat, LOS at the three study intersections would not be reduced below applicable standards.

Public Access Alternative A: Negligible. No construction activities would occur that could adversely affect parking.

Restoration Alternative B1–B5, C: Major Adverse. Impacts are considered major adverse and significant. They would be reduced somewhat by implementation of mitigation measure TC-MM-1 (Construction Traffic Management Plan), but would remain significant after mitigation.

Impact TC-P2: Effects of Construction Mobilization and Materials Deliveries (Individual, Short-Term, Year 0)

Impact mechanisms would be as described under Impact TC-R1, but would be of lesser intensity due to the smaller extent and duration of parking lot construction.

Public Access Alternative A: Negligible. No construction activities would occur that could adversely affect parking.

Restoration Alternative B1–B5, C: Minor Adverse. Effects would be limited to one season. LOS standards could be temporarily exceeded and traveler safety could be compromised for parts of this construction window, but exceedances would be localized and of comparatively short duration. Mitigation measure TC-

MM-1 (Construction Traffic Management Plan) is recommended to minimize impacts.

Impact TC-P3: Effects of Construction Worker Trips to and from Site (Individual, Short-Term, Year 0)

Impact mechanisms would be as described under Impact TC-R2, but would be of lesser intensity due to the shorter duration of parking lot construction.

Public Access Alternative A: Negligible. No additional workers would access the site under the No Action Alternative.

Public Access Alternatives B1, B2, B3, B4, B5, and C: Negligible. Effects on regional traffic flow and intersection LOS are not expected to be noticeable under any of the action alternatives. Effects on traffic along Pacific Way and LOS at the Pacific Way–Hwy 1 intersection could be more noticeable but would be limited in duration and are also considered negligible.

Impact TC-P4: Effects of Construction Worker Parking (Individual, Short-Term, Year 0)

Impact mechanisms would be as described under Impact TC-R2; worker parking would be included in the construction staging area.

Public Access Alternative A: Negligible. No additional worker parking would be needed under the No Action Alternative.

Public Access Alternatives B1, B2, B3, B4, B5, and C: Negligible. Impacts associated with construction worker parking for activities related to the Public Access Alternatives would be minimal, because no additional reduction in parking availability (other than that needed to accommodate construction staging, discussed in Impact TC-P1 above) would be required.

Impact TC-P5: Effects of Truck Trips Associated with Fill Disposal (Individual, Short-Term, Year 0)

Impact mechanisms would be as described under Impact TC-R4. Impact levels are discussed in the context of Impact TC-R4 since the Public Access Alternatives would either increase or reduce the amount of excess fill that would need to be hauled for the Restoration Alternatives. Table 2-7 summarizes excavation, fill use, and fill disposal needs under the five public access action alternatives. Of the action alternatives, only Alternative B1 would generate a greater volume of cut materials than it could reuse onsite; the remaining 2,800 cubic yards would require offsite disposal, and could be routed to any of the five locations discussed under impact TC-R4. Alternatives B2 through B5 and Alternative C would all require more fill than they would generate onsite, and could accommodate a portion of the excavated materials generated during restoration.

Public Access Alternative A: Negligible. No additional fill disposal would be required under the No Action Alternative. There would be no impact.

Public Access Alternative B1: Minor Adverse. Alternative B1 would require disposal of approximately 2,800 cubic yards of fill. Assuming that all excavation occurs during a single construction season, this represents 280 truck trips over a period of approximately 3 months or about 60 workdays, translating to four to five truck trips per day. With larger 20-cy trucks, this could be halved, to approximately two to three truck trips per day.

Using an alternate approach of assuming a maximum excavation production rate of 500 CY per day, the daily number of trips could be slightly larger: 50 per day/six to seven per hour using 10-CY capacity trucks, or 25 per day/three to four truck trips per hour using 20-CY capacity trucks. This would concentrate hauling to approximately six working days. In actuality, it is likely that fill hauling would be dispersed over the 3-year construction window.

Because the quantity of fill material could be disposed of locally (i.e., not at Hamilton Air Force base), most trucks would not have to travel down the heavily used stretch of Hwy 1 between Panoramic Highway and Tam Junction. At any of the trip generation levels identified above, local and regional effects would be perceptible but limited and are considered minor but less than significant. Implementation of mitigation measure TC-MM-1 (Construction Traffic Management Plan) is recommended.

Public Access Alternative B2: Minor Beneficial. This alternative would have a demand for fill of approximately 700 CY. Assuming that the fill would have been hauled during a single construction season, this represents a reduction in fill hauling of 70 truck trips over a period of approximately 3 months or about 60 workdays, translating to approximately one truck trip per day. With larger 20-cy trucks, it would reduce hauling by approximately one truck trip every other day.

Using an alternate approach of assuming that fill would be hauled at a maximum rate of 500 CY per day, this alternative would eliminate one to two days of fill hauling associated with the restoration.

Public Access Alternative B3: Minor Beneficial. This alternative would have a demand for fill of approximately 2,700 CY. Assuming that the fill would have been hauled during a single construction season, this represents a reduction in fill hauling of 270 truck trips over a period of approximately 3 months or about 60 workdays, translating to approximately four to five truck trips per day. With larger 20-cy trucks, it would reduce hauling by approximately two truck trips per day.

Using an alternate approach of assuming that fill would be hauled at a maximum rate of 500 CY per day, this alternative would eliminate five to six days of fill hauling associated with the restoration.

Public Access Alternative B4: Minor Beneficial. This alternative would have a demand for fill of approximately 2,800 CY. Assuming that the fill would have been hauled during a single construction season, this represents a reduction in fill hauling of 280 truck trips over a period of approximately 3 months or about 60

workdays, translating to approximately four to five truck trips per day. With larger 20-cy trucks, it would reduce hauling by approximately two to three truck trips per day.

Using an alternate approach of assuming that fill would be hauled at a maximum rate of 500 CY per day, this alternative would eliminate five to six days of fill hauling associated with the restoration.

Public Access Alternative B5: Minor Beneficial. This alternative would have a demand for fill of approximately 8,600 CY. This represents a reduction in fill hauling of 8,600 truck trips. Assuming that fill could be reused at a maximum rate of 500 CY per day, this alternative would eliminate approximately 17 days of fill hauling associated with the restoration.

Public Access Alternative C: Minor Beneficial. This alternative would have a demand for fill of approximately 3,200 CY. Assuming that the fill would have been hauled during a single construction season, this represents a reduction in fill hauling of 320 truck trips over a period of approximately 3 months or about 60 workdays, translating to approximately five to six truck trips per day. With larger 20-cy trucks, it would reduce hauling by approximately two to three truck trips per day.

Using an alternate approach of assuming that fill would be hauled at a maximum rate of 500 CY per day, this alternative would eliminate six to seven days of fill hauling associated with the restoration.

Impact TC-P6: Long-Term Changes in Parking Availability (Individual, Long-Term, Years 5 and 50)

Under the No Action Alternative (Alternative A), parking would remain in its current configuration, with 175 cars accommodated in the existing lot near the beach. There would be no change in the way parking availability.

All of the public access action alternatives focus on modifications to parking capacity and configuration. This not only affects the periods when adequate parking capacity is available, but also has several corollary effects. First, the reduction of available parking would be likely to displace visitors to other park facilities along Hwy 1, with corresponding increases in traffic at those locations. It would also be likely to result in illegal parking on the shoulders of Pacific Way, Hwy 1, and other roadways in the adjacent residential area, as well as at the Pelican Inn and possibly Golden Gate Dairy. Vehicle queuing and effects on LOS are described separately under Impacts TC-P7 and TC-P8 respectively.

Table 4.3.4.2-3 summarizes existing parking demand based on traffic studies conducted for the project between 2001 and 2004, and compares it to parking availability under Alternatives B1 through C, highlighting projected deficits and shortfalls. The No Action Alternative is also shown for comparison.

Table 4.3.4.2-3. Summary of Projected Parking Surpluses and Shortfalls under Public Access Alternatives

Public Access Alternative	# Spaces Provided	Summer Peak Season		Shoulder Seasons		Winter Off-Peak Season	
		Weekday (Demand= 159)	Weekend (Demand= 201)	Weekday (Demand= 115)	Weekend (Demand= 160)	Weekday (Demand= 30)	Weekend (Demand= 120)
A (No Action)	175	+16	**–26**	+60	+15	+145	+55
B1	50	**–109**	**–151**	**–65**	**–110**	+20	**–70**
B2	145	**–14**	**–56**	+30	**–15**	+115	+25
B3	175	+16	**–26**	+60	+15	+145	+55
B4	175	+16	**–26**	+60	+15	+145	+55
B5	200	+41	**–1**	+85	+40	+170	+80
C	118	**–41**	**–83**	+3	**–42**	+88	**–2**

Source: DKS Associates 2006, Appendix D

Note that under all of the Public Access Alternatives there would be at least a minor parking shortfall on peak-season weekends, when site use and parking demand is highest. Alternative B5, which would provide 25 more spaces than are now available, would come closest to accommodating projected peak parking needs, with only a minimal shortfall. Similarly, only Alternatives A, B3, B4, and B5 are expected to meet or exceed peak-season weekday demand. Alternatives B1 and B2 would likely also show substantial deficits during the shoulder and off-seasons; of the alternatives, only A, B3, B4, and B5 would meet existing shoulder and off-season demand.

Public Access Alternative A: Negligible. Parking capacity remains the same as baseline condition. Overflow of vehicles parking on local streets would remain during peak season weekdays and weekend only.

Public Access Alternative B1: Major Adverse. Parking capacity would not be adequate. Provision of 50 spaces would only meet parking demand on weekdays during the off-peak season. Mitigation for this significant impact could include provision of additional parking; however, this would require redesign of this alternative and is not considered consistent with its purpose and intent.

Public Access Alternative B2: Minor Adverse. Parking capacity would not be adequate. Provision of 145 spaces would not meet the parking demand expected on weekdays and weekends during the peak season and on weekends during off-peak season.

Public Access Alternative B3, B4: Negligible. Parking capacity would remain the same as baseline condition.

Public Access Alternative B5: Minor Beneficial. Parking capacity would be adequate to meet the expected demand for weekdays during the peak, shoulder, and off-peak seasons, and on weekends during the shoulder and off-peak season. Parking demand for weekends during the peak season is estimated to be 201 spaces.

Public Access Alternative C: Moderate Adverse. Parking capacity would not be adequate. Parking demand would not be met on weekday/ weekend during peak season and on weekends during shoulder and off-peak seasons. Mitigation for this significant impact could include provision of additional parking; however, this would require redesign of this alternative and is not considered consistent with its purpose and intent.

Impact TC-P7: Effects of Parking Lot Size on Vehicle Queuing and Circulation (Individual, Long-Term, Years 5 and 50)

One effect of reduced parking availability would be increased queuing, as visitors wait for spaces to become available. Parking queues would be expected to form at any time when demand exceeds availability. Although some vehicles might wait within the parking lot, for the purposes of this analysis, a worst-case scenario was assumed in which queues form at the entrance to the visitor lot on Pacific Way, causing congestion on Pacific Way and reducing access for visitors and residents. This also had adverse effects on the ability to provide access for emergency vehicles along Pacific Way.

Table 4.3.4.2-4 summarizes anticipated parking queue lengths when parking demand exceeds supply. This table was based on parking utilization surveys conducted between 2001 and 2004 to identify maximum hourly vehicle arrival rates at Muir Beach, and assumes that drivers would be unwilling to wait longer than 15 minutes for parking. The length of the parking queue (number of vehicles waiting) was calculated as

vehicles arriving per minute x 15 minutes.

Table 4.3.4.2-4. Anticipated Formation of Parking Queues

		Peak Season	Shoulder Seasons	Off-Peak Season
Weekdays	Vehicle Arrivals per Hour	103	103	30
	Vehicle Arrivals per Minute	1.72	1.72	0.50
	Maximum # of Vehicles in Queue	**26**	**26**	**8**
Weekends	Vehicle Arrivals per Hour	122	88	124
	Vehicle Arrivals per Minute	2.03	1.47	2.07
	Maximum # of Vehicles Queue	**31**	**22**	**31**

Source: DKS Associates 2006, Appendix D

Note: no vehicle arrival rate was available for the off-peak season. Maximum arrival rate was assumed to be the same as maximum parking demand (see Table 4.3.2.2-3).

Table 4.3.4.2-5 shows the maximum number of vehicles in queue under the various alternatives, based on parking utilization surveys conducted for the project between 2001 and 2004.

Table 4.3.4.2-5. Number of Vehicles in Queue under Public Access Alternatives

Public Access Alternative	Summer Peak Season		Shoulder Seasons		Winter Off-Peak Season	
	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend
A (No Action)	0	**31**	0	0	0	0
B1	**26**	**31**	**26**	**22**	0	**31**
B2	**26**	**31**	0	**22**	0	0
B3	0	**31**	0	0	0	0
B4	0	**31**	0	0	0	0
B5	0	**31**	0	0	0	0
C	**26**	**31**	0	**22**	0	**31**

Source: DKS Associates 2006, Appendix D

As shown in Table 4.3.4.2-5 above, queuing would be expected to occur most frequently under Alternative B1, and would occur during peak and shoulder season weekdays and weekends, and off-season weekends. It would also be a common occurrence under Alternative C during peak season weekdays and weekends, and shoulder and off-season weekends. Queuing would be a

somewhat less frequent occurrence under Alternative B2, occurring during peak season weekdays and weekends, and shoulder season weekends. Under Alternatives A, B3, B4, and B5, queuing would be expected only on peak-season weekend days.

As shown in Table 4.3.4.2-5, as many as 26–31 vehicles could be waiting for parking at any given time on peak-season weekend days. Variability during the off-season is greater because of the greater disparity between weekday and weekend demand, but the worst case for the off-season is similar. The worst-case queue length would be the same under all alternatives because the location of the bottleneck would be at the parking lot entrance, regardless of the size of the parking lot. Queues might move more quickly under the alternatives with more parking spaces available, but this is difficult to predict in a meaningful way, because it would depend on the length of individual visitors' stays on any given day.

Public Access Alternative A: Negligible. Vehicular queuing would continue to occur during weekends of the peak season.

Public Access Alternative B1: Major Adverse. Vehicular queuing would occur at all times except weekdays during the off-peak season.

Public Access Alternative B2: Minor Adverse. Vehicular queuing would occur during peak season weekdays and weekends, and shoulder season weekends.

Public Access Alternative B3: Negligible. Vehicular queuing would occur as under existing conditions.

Public Access Alternative B4: Minor Beneficial. While vehicular queuing would still occur during weekends of the peak season, the parking lot would provide stacking space for approximately 15 cars, reducing the extent of queuing on Pacific Way.

Public Access Alternative B5: Negligible. While vehicular queuing would still occur during weekends of the peak season, the parking lot would have an additional capacity of 25 cars, reducing to some extent the queuing on Pacific Way.

Access to the parking lot would be provided by a narrow, sharp-turn driveway. Vehicles entering the parking lot could experience a short delay as vehicles exit the parking lot. Vehicles parked on the northern side, parallel to Pacific Way, might conflict with vehicles entering/exiting as they try to park/back up.

Taken together, conditions are expected to be substantively similar to existing conditions.

Public Access Alternative C: Moderate Adverse. Queuing would be a common occurrence under Alternative C during peak season weekdays and weekends, and shoulder and off-season weekends. Because of the location of the parking lot,

these queues would form on Hwy 1, impacting all drivers on that roadway, not just those using Pacific Way. The limited sight distance from the parking lot entrance would create a potential for unsafe traffic movements and could also adversely affect emergency vehicles on Hwy 1.

While it is conceivable that the number of vehicles using Pacific Way could be reduced somewhat by relocation of the parking lot, pick-up and drop-off traffic is expected to result in conditions that do not deviate substantially from existing conditions.

Impact TC-P8: Effects of Parking Lot Size on LOS and Intersection Delay (Individual, Long-Term, Years 5 and 50)

Parking lot size would affect intersection LOS and delays as vehicles not able to find a parking space would depart the area. The effects on LOS and delay are shown in Tables 4.3.4.2-6 (Weekdays) and 4.3.4.2-7 (Weekends). Baseline traffic data used to construct these tables were based on studies conducted for the project between 2001 and 2004. Traffic modeling assumes that Alternative C would only affect delays and LOS at Muir Woods Road, due to its location on Hwy 1, and was not evaluated for weekdays during the shoulder and off-peak seasons.

Table 4.3.4.2-6. Intersection Level of Service Comparison Summary, Weekdays

	Alternative	Parking Spaces	Peak		Shoulder		Off-Peak	
			Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[2]
Hwy 1 & Muir Woods Rd	A	175	16.5	C	13.1	B	12.4	B
	B1	50	21.3	C	13.1	B	12.4	B
	B2	145	19.9	C	13.1	B	12.4	B
	B3	175	16.5	C	13.1	B	12.4	B
	B4	175	16.5	C	13.1	B	12.4	B
	C	118	20.5	C	-	-	-	-
Hwy 1 & Pacific Way	A	175	14.8	B	11.5	B	11.0	B
	B1	50	15.3	C	11.5	B	11.0	B
	B2	145	13.1	B	11.5	B	11.0	B
	B3	175	14.8	B	11.5	B	11.0	B
	B4	175	14.8	B	11.5	B	11.0	B
	C	118	-	-	-	-	-	-
Hwy 1 & Panoramic Hwy	A	175	>50	F	>50	F	28.9	D
	B1	50	>50	F	>50	F	28.9	D
	B2	145	>50	F	>50	F	28.9	D
	B3	175	>50	F	>50	F	28.9	D
	B4	175	>50	F	>50	F	28.9	D
	C	118	-	-	-	-	-	-

Source: DKS Associates 2006, Appendix D

1. Delay: Approximate approach delay per vehicle, in seconds per vehicle.
2. LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Table 4.3.4.2-7. Intersection Level of Service Comparison Summary, Weekends

	Alternative	Parking Spaces	Peak		Shoulder		Off-Peak	
			Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[2]
Hwy 1 & Muir Woods Rd	A	175	>50	F	>50	F	24.3	C
	B1	50	>50	F	>50	F	26.5	D
	B2	145	>50	F	>50	F	24.6	D
	B3	175	>50	F	>50	F	24.3	D
	B4	175	>50	F	>50	F	24.3	D
	C	118	>50	F	>50	F	25.4	D
Hwy 1 & Pacific Way	A	175	17.9	C	15.2	C	11.3	B
	B1	50	29.9	D	17.9	C	12.7	B
	B2	145	21.3	C	15.2	C	11.5	B
	B3	175	19.4	C	15.2	C	11.3	B
	B4	175	19.4	C	15.2	C	11.3	B
	C	118	-	-	-	-	-	-
Hwy 1 & Panoramic Hwy	A	175	>50	F	>50	F	>50	F
	B1	50	>50	F	>50	F	>50	F
	B2	145	>50	F	>50	F	>50	F
	B3	175	>50	F	>50	F	>50	F
	B4	175	>50	F	>50	F	>50	F
	C	118	-	-	-	-	-	-

Source: DKS Associates 2006, Appendix D

1. Delay: Approximate approach delay per vehicle, in seconds per vehicle.
2. LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Public Access Alternative A: Negligible. Existing LOS and delay would remain the same as baseline condition.

Public Access Alternative B1: Minor Adverse. At Muir Woods Road, delays would increase slightly on peak season weekdays and off-peak season weekends. At Pacific Way, delays would increase slightly on all weekends and on peak season weekdays. At Panoramic Highway, delays would not change. LOS at Pacific Way would degrade from LOS B to LOS C during peak season

weekdays, and from LOS C to LOS D during peak season weekends. LOS at Muir Woods Road would degrade from LOS C to LOS D during off-peak season weekends. LOS would not be degraded below Marin County standards.

Public Access Alternative B2: Minor Adverse. At Muir Woods Road, delays would increase slightly on peak season weekdays and off-peak season weekends. At Pacific Way, delays would decrease slightly on peak season weekdays, and increase slightly on peak season and off-peak season weekends. LOS at Muir Woods Road would degrade from LOS C to LOS D during off-peak season weekends. LOS would not be degraded below Marin County standards.

Public Access Alternatives B3 and B4: Minor Adverse. Delays would increase slightly at Pacific Way during peak season weekends. LOS at Muir Woods Road would degrade from LOS C to LOS D during off-peak season weekends.

Public Access Alternative B5: Negligible. The number of vehicles at the study intersections during peak periods would remain the same, and this alternative would result in similar intersection operation as the existing condition.

Public Access Alternative C: Minor Adverse. At Muir Woods Road, delays would increase slightly on peak season weekdays and off-peak season weekends. LOS at Muir Woods Road would degrade from LOS C to LOS D during off-peak season weekends. LOS would not be degraded below Marin County standards.

Impact TC-P9: Long-Term Effects on Pedestrian, Equestrian, and Bicyclist Safety (Individual, Long-Term, Years 5 and 50).

Under all action alternatives, the new grade-separated trail from Hwy 1 to the parking lot would improve safety for pedestrians. The largest benefits would occur during periods of high traffic volumes on Pacific Way, as the potential for conflicts between vehicle and foot traffic would be the greatest. Parking lot size and configuration could have additional effects on safety based on the extent of exposure of pedestrians, equestrians, and bicyclists to vehicles.

Public Access Alternative A: Negligible. Existing pedestrian, equestrian, and bicyclist movements along the roadway network would remain the same as baseline condition.

Public Access Alternative B1: Minor Adverse. Increased numbers of vehicles circling the parking lot could increase conflicts with pedestrians. This would be noticeable whenever parking demand exceeds supply (all times except weekdays during the off-peak season).

Public Access Alternative B2: Minor Adverse. Increased numbers of vehicles circling the parking lot could increase conflicts with pedestrians. This would be noticeable whenever parking demand exceeds supply (weekdays and weekends during the peak season and on weekends during off-peak season).

Public Access Alternative B3: Minor Beneficial. Safety hazards would remain similar to baseline conditions.

Public Access Alternative B4: Minor Beneficial. Rotation of parking lot would increase pedestrian and vehicular interaction because most of the parking spaces are located away from the boardwalk. However, the provision of stacking space would be likely to reduce the potential for vehicles to circulate the parking lot.

Public Access Alternative B5: Moderate Beneficial. Increased parking capacity would reduce the potential for vehicles to circle the lot, reducing interactions with pedestrians, equestrians, and bicyclists.

Public Access Alternative C: Moderate Adverse. Increased vehicles circling the lot, and its location on Hwy 1, would create a safety hazard for pedestrians, equestrians, and bicyclists. This would be noticeable whenever parking demand exceeds supply (weekdays and weekends during the peak season and on weekends during shoulder and off-peak seasons). While the new trail would provide benefits, these would be offset by the large number of pedestrians using the trail from the lot to the beach, creating potential for conflicts and safety hazards. The combination of parking lot and trail hazards make this impact significant. No mitigation is available without changing alternative design.

Impact TC-P10: Long-Term Effects on Elderly and Disabled Accessibility (Individual, Long-Term, Years 5 and 50)

Hazards associated with vehicular conflicts with elderly and persons with disabilities would be similar to the mechanisms described under Impact TC-P9 above. However, the location of the lot could also affect accessibility due to the distance from the parking lot to the beach, although disabled-accessible parking would be provided close to the beach under all alternatives.

Public Access Alternative A: Negligible. Elderly and disabled accessibility would remain unchanged.

Public Access Alternative B1, B2, B3, and B5: Negligible. Based on parking lot configuration, elderly and disabled accessibility would remain similar to the existing condition.

Public Access Alternative B4: Minor Adverse. Rotation of parking lot may discourage elderly, persons with disabilities, and children, because the distance to the beach from the parking lot would increase on average.

Public Access Alternative C: Negligible. Disabled-accessible parking would be provided near the boardwalk.

Impact TC-P11: Long-Term Effects on Emergency Access to Site (Individual, Long-Term, Years 5 and 50)

The effects of parking lot size on vehicular circulation along Hwy 1 and Pacific Way, and its relationship to access for emergency vehicles, has been discussed under Impact TC-P7. Rather, this impact discussion focuses on emergency access along the levee road. Currently, the levee road serves as the emergency access route to the portion of the site that is east of Pacific Way and Redwood Creek. While the action alternatives involve removal of the levee road, the existing

perimeter road along the southern edge of the site would be upgraded such that emergency access is still provided. This new route is slightly longer, and so could lengthen response times slightly (estimated at approximately one minute.

Public Access Alternative A: Negligible. Existing emergency access conditions would remain unchanged.

Public Access Alternatives B1, B2, B3, B4, B5, and C: Minor Adverse. The increased length of the replacement route would result in minor adverse impacts.

Impact TC-P12: Consistency with NPS Policies Related to Parking (Individual, Long-Term, Years 5 and 50)

NPS Management Policies (National Park Service 2006a) state that permanent parking areas should be sized for the use anticipated on the average weekend day during the peak season of use. This would correspond to the parking demand associated with the weekend of the peak season. For the purposes of this impact, violation of this policy is considered a significant impact.

Public Access Alternative A: Negligible. The existing parking lot accommodates all demands except for the peak weekend; as such, it does not meet the requirements of NPS policy. However, since the No Action Alternative would not represent a change from this condition, the impacts of the No Action Alternative are considered negligible.

Public Access Alternative B1: Major Adverse. Given the shortage of parking capacity under most seasons, this alternative would be extremely noncompliant with NPS policy.

Public Access Alternatives B2 and C: Moderate Adverse. Given the shortage of parking capacity for some seasons, these alternatives would be noncompliant with NPS policy.

Public Access Alternatives B3, B4, and B5: Negligible. Since parking capacity would remain unchanged, impacts are considered negligible.

Bridge Alternatives

Table 4.3.4.2-8 summarizes the potential impacts of Bridge Alternatives on traffic and transportation in the study area. The Bridge Alternatives are described in Chapter 2.

Table 4.3.4.2-8. Potential Traffic and Circulation Impacts from the Bridge Alternatives

Impact	Significance Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					Mitigation Measure
	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	
TC-B1: Effects of Construction Mobilization and Materials Deliveries	Negligible	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	TC-MM-1: Construction Traffic Management Plan
TC-B2: Effects of Construction Worker Trips to and from Site	Negligible	Negligible	Negligible	Negligible	Negligible	
TC-B3: Effects of Construction Worker Parking	Negligible	Negligible	Negligible	Negligible	Negligible	
TC-B4: Effects of Truck Trips Associated with Fill Hauling	Negligible	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	TC-MM-1
TC-B5: Effects on Access and Safety on Pacific Way During Bridge Construction	Negligible	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	TC-MM-1
TC-B6: Improvements to Circulation from New Bridge	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	

Impact TC-B1: Effects of Construction Mobilization and Materials Deliveries (Individual, Short-Term, Year 0)

Impact mechanisms would be as described under Impact TC-R1, but would be of lesser intensity due to the smaller extent and duration of bridge construction.

Bridge Alternative BR0: Negligible. No construction activities would occur that could adversely affect parking.

Bridge Alternative BR1, BR2, BR3, and BR4: Minor Adverse. Effects would be limited to one season. LOS standards could be temporarily exceeded and traveler safety could be compromised for parts of this construction window, but exceedances would be localized and of comparatively short duration. Mitigation measure TC-MM-1 (Construction Traffic Management Plan) is recommended to minimize impacts.

Impact TC-B2: Effects of Construction Worker Trips to and from Site (Individual, Short-Term, Year 0)

Impact mechanisms would be as described under Impact TC-R2, but would be of lesser intensity due to the shorter duration of parking lot construction.

Bridge Alternative BR0: Negligible. No additional workers would access the site under the No Action Alternative.

Bridge Alternatives BR1, BR2, BR3, BR4: Negligible. Effects on regional traffic flow and intersection LOS are not expected to be noticeable under any of the action alternatives. Effects on traffic along Pacific Way and LOS at the Pacific Way–Hwy 1 intersection could be more noticeable but would be limited in duration and are also considered negligible.

Impact TC-B3: Effects of Construction Worker Parking (Individual, Short-Term, Year 0)

Impact mechanisms would be as described under Impact TC-R2; worker parking would be included in the construction staging area.

Bridge Alternative BR0: Negligible. No additional worker parking would be needed under the No Action Alternative.

Bridge Alternatives BR1, BR2, BR3, BR4: Negligible. Impacts associated with construction worker parking for activities related to the bridge construction would be minimal, because no additional reduction in parking availability (other than that needed to accommodate construction staging, discussed in Impact TC-P1 above) would be required.

Impact TC-B4: Effects of Truck Trips Associated with Fill Hauling (Individual, Short-Term, Year 0)

As discussed in Chapter 2, bridge construction would require importation of fill for the roadway approaches. Due to the engineered nature of this fill, it is assumed that excavated material generated as part of the restoration could not be used. Importation of fill would generate heavy truck traffic along Pacific Way, Hwy 1 to the south of the project, and potentially other roadways depending on the source of the fill. The number of trips would depend on the volume of fill needed for the Bridge Alternative (see Table 2-5). Generally speaking, however, additional heavy truck traffic on narrow winding roadways would be likely to obstruct traffic at least intermittently, and could create safety hazards for other vehicles and for bicyclists and pedestrians.

Bridge Alternative BR0: Negligible. No fill would need to be imported.

Bridge Alternative BR1: Minor Adverse. Based on a fill volume of 2,000 cubic yards (see Table 2-5), approximately 200 truck trips would be generated using standard 10-CY capacity trucks. The duration of hauling could range from 4 days (assuming a maximum rate of 500 CY/day) to the entire construction season (approximately 3 months or about 60 workdays), translating to between three and

50 truck trips per day. With larger 20-cy trucks, this could be halved, to approximately two to 25 truck trips per day.

While it is likely that trucks would travel down the heavily used stretch of Hwy 1 between Panoramic Highway and Tam Junction, the duration would be short and intensity is anticipated to be relatively low. Local and regional effects would be perceptible but limited and are considered minor. Implementation of mitigation measure TC-MM-1 (Construction Traffic Management Plan) is recommended.

Bridge Alternative BR2: Minor Adverse. Impacts would be similar to Bridge Alternative BR1; however, this alternative would only need 400 CY of fill, resulting in 1/5 as many truck trips as under Bridge Alternative B1. Local and regional effects would be perceptible but limited and are considered minor. Implementation of mitigation measure TC-MM-1 (Construction Traffic Management Plan) is recommended.

Bridge Alternative BR3: Minor Adverse. Impacts would be similar to Bridge Alternative BR1; however, this alternative would only need 1,000 CY of fill, resulting in half as many truck trips as under Bridge Alternative B1. Local and regional effects would be perceptible but limited and are considered minor. Implementation of mitigation measure TC-MM-1 (Construction Traffic Management Plan) is recommended.

Bridge Alternative BR4: Minor Adverse. Impacts would be similar to Bridge Alternative BR1; however, this alternative would only need 1,110 CY of fill, resulting in just over half as many truck trips as under Bridge Alternative B1. Local and regional effects would be perceptible but limited and are considered minor. Implementation of mitigation measure TC-MM-1 (Construction Traffic Management Plan) is recommended.

Impact TC-B5: Effects on Access and Safety on Pacific Way During Bridge Construction (Individual, Short-Term, Year 0)

Prior to construction of the bridge, a temporary bypass road and bridge over Redwood Creek would be constructed to provide access to Muir Beach residents and visitors. This bypass road is planned to be immediately to the south of the existing Pacific Way. The bypass road would be decommissioned once the new bridge is complete. This would pose a slight inconvenience, but it would not eliminate access for residents and visitors. However, it could create issues related to vehicle conflicts, vehicle and pedestrian safety, and emergency vehicle access, particularly during peak periods of traffic.

Bridge Alternative BR0: Negligible. No construction would occur.

Bridge Alternative BR1-BR4: Minor Adverse. Impacts would be minor. Mitigation measure TC-MM-1 (Construction Traffic Management Plan) is recommended to minimize impacts.

Impact TC-B6: Improvements to Circulation from the New Bridge (Individual, Long-Term, Years 5 and 50)

Impacts related to access during flood conditions are discussed Section 4.3.4.4 under Impact PS-B4.

The current bridge is only wide enough for one direction of traffic. The new bridge would allow for two-way traffic, improving vehicular circulation. This would be most highly noticeable at high traffic times. In addition, the new bridge would improve access for emergency vehicles and provide for improved pedestrian safety by having a pedestrian path that would be attached to the bridge, but separate from the traffic lanes.

Bridge Alternative BR0: Negligible. The existing bridge would remain.

Bridge Alternative BR1-BR4: Moderate Beneficial.

Fill Disposal Alternatives

Table 4.3.4.2-9 summarizes the potential impacts of Fill Disposal Alternatives on traffic and transportation in the study area. The Fill Disposal Alternatives are described in Chapter 2.

Table 4.3.4.2-9. Potential Traffic and Circulation Impacts from the Fill Disposal Alternatives

	Significance Level (before Mitigation/after Mitigation) **Bold** denotes a significant adverse impact					
Impact	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail*	Mitigation Measure
TC-F1: Effects of Fill Disposal Site Preparation	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	Negligible	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	TC-MM-1: Construction Traffic Management Plan
TC-F2: Effects of Truck Trips Associated with Fill Hauling	Minor Adverse/ Minor Adverse	Minor Adverse/ Minor Adverse	**Major Adverse/ Major Adverse**	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	TC-MM-1

Note:

* The analysis of the two trail alternatives only considers the effects of hauling the fill to the sites. For the coastal trail, impacts of using the fill to recontour the trail are also considered.

Impact TC-F1: Effects of Construction Mobilization and Materials Deliveries (Individual, Short-Term, Year 0)

Impact mechanisms would be as described under Impact TC-R1; the fill disposal sites may need to be prepared through construction of access roads, etc.

Unused Reservoir Pit, Upper Banducci Field, Dias Ridge Trail, and Coastal Trail: Minor Adverse. Some traffic could be generated through improvements to access roads and site preparation. Mitigation measure TC-MM-1 (Construction Traffic Management Plan) is recommended to minimize impacts.

Hamilton: Negligible. The Hamilton site would not need any additional site preparation to receive fill material from the Big Lagoon project.

Impact TC-F2: Effects of Truck Trips Associated with Fill Hauling (Cumulative, Short-Term, Year 0)

Removal of excavated materials for disposal would generate heavy truck traffic along Pacific Way, on regional access routes, and on other local roadways outside the immediate project vicinity. Additional heavy truck traffic on narrow winding roadways would be likely to obstruct traffic at least intermittently, and could create safety hazards for other vehicles and for bicyclists and pedestrians.

The impact analysis assumes that the maximum capacity of each fill disposal site is utilized; however, this might not be the case. In addition, it is only anticipated that Hamilton would be used in the event that Restoration Alternatives 3 or 4 were selected, due to the fact that the fill volume under Restoration Alternative 2 could be disposed of within the watershed. Effects of truck traffic could include traffic safety issues at the intersection of Pacific Way and Hwy 1 (where applicable), as well as at other difficult intersections (e.g., Panoramic Highway).

Unused Reservoir Pit: Minor Adverse. Based on a maximum of 23,800 CY of fill that this site could accommodate, a total of between 1,190 and 2,380 truck trips would be generated. While the maximum excavation production rate of 500 CY/day would result in up to 50 truck trips per day and could be completed in one construction season, it is more likely that truck trips would be spread out throughout various portions of the 3- to 4-year construction period. The haul route consists of a steep and windy portion of Hwy 1 extending north from Pacific Way for approximately 0.75 miles. The route currently operates at LOS A, and it is possible that the truck trips would cause temporary degradation of LOS. Local effects would be perceptible but limited and are considered minor. Implementation of mitigation measure TC-MM-1 (Construction Traffic Management Plan) is recommended.

Upper Banducci Field: Minor Adverse. Based on a maximum of 12,500 CY of fill that this site could accommodate in the form of stockpiles, spreading and compostable material, a total of between 625 and 1,250 truck trips would be generated. While the maximum excavation production rate of 500 CY/day would result in up to 50 truck trips per day and could be completed in one construction season, it is more likely that truck trips would be spread out throughout various portions of the 3- to 4-year construction period. The haul route is short (~0.5 miles), and would only proceed north on Hwy 1 a short distance before reaching the dirt road that accesses the site. The route currently operates at LOS A, and it is possible that the truck trips would cause temporary degradation of LOS in this short stretch. Local effects would be perceptible but limited and are considered

minor. Implementation of mitigation measure TC-MM-1 (Construction Traffic Management Plan) is recommended.

Hamilton: Major Adverse. Based on a huge quantity of fill that this site could accommodate, the project maximum of 178,000 CY of fill could be hauled to this site. This translates to a total of between 8,900 and 17,800 truck trips spread out throughout a 4-year construction period. The 20-mile haul route travels through the very congested portion of Hwy 1 between Muir Beach and Tam Junction, and then joins US-101. The portions of US-101 on which the trucks would travel currently operate at LOS D, E, and F, and Tam Junction is also subject to queuing. Because this would add additional traffic to these roadways, and the duration of hauling is lengthy, this is considered a major adverse impact. Implementation of mitigation measure TC-MM-1 (Construction Traffic Management Plan) would reduce impacts, but not below the level of major.

Dias Ridge Trail: Moderate Adverse. Based on a maximum of 24,000 CY of fill that this site could accommodate, a total of ~~200 to 400~~1,200 to 2,400 truck trips would be generated. These could occur over as little as ~~2 weeks~~ 3 months although it is more likely that they would be spread out over one or two construction seasons. The 2.5 mile haul route south traverses a windy portion of Hwy 1, and has to make a difficult turn onto Panoramic Highway, which would be likely to create queuing due to the currently low level of LOS at that intersection (LOS D or F). Because of the existing degraded LOS at the intersection with Panoramic Highway, impacts are considered moderate and significant. Implementation of mitigation measure TC-MM-1 (Construction Traffic Management Plan) would reduce impacts below significance thresholds.

Coastal Trail. Moderate Adverse. Based on a maximum of 4,000 CY of fill that this site could accommodate, and assuming smaller 10-CY trucks would be required, a total of 400 truck trips would occur. These could occur over as little as 2 weeks although it is more likely that they would be spread out over one or two construction seasons. While delivery of fill to the Coastal Trail rehabilitation site would not use a public road, a looped route would likely be needed, which would involve the use of Tennessee Valley and Hwy 1. Because this is a congested portion of Hwy 1, impacts are considered moderate and significant. Implementation of mitigation measure TC-MM-1 (Construction Traffic Management Plan) would reduce impacts below significance thresholds.

Mitigation Measures

Mitigation Measure TC-MM-1: Construction Traffic Management Plan

As described in Chapter 2, appropriate signage would be placed at the intersection of Pacific Way and Hwy 1 to deter visitors from seeking parking at the beach during construction. Chapter 2 also outlines a communication strategy to keep residents and visitors apprised of the construction at Muir Beach, to help reduce parking demand and traffic conflicts. In addition to these measures, the following will be implemented:

Develop and Implement a Traffic Control Plan

NPS and the County, in coordination with Caltrans, shall develop and implement traffic control plan(s) for construction of the project. The plan shall reduce the effects of construction on the roadway system in the project area throughout the construction period. Construction contractors shall follow the standard construction specifications of affected jurisdictions and obtain the appropriate encroachment permits. The conditions of the encroachment permit shall be incorporated into the construction contract and shall be enforced by the agency that issues the encroachment permit.

The following travel lane widths, speeds, and conditions ~~shall~~would be maintained during project construction as much as possible:

- For two-way traffic operations, the minimum width for the traveled way shall be 20 feet, or a minimum of a 10-foot traffic lane in each direction.
- For one-way operation, the minimum width for the traveled way shall be 12 feet where some shoulder exists. In those areas where no shoulder is present, the minimum width for the traffic lanes shall be 13 feet.
- Any roadway or lane closures shall be coordinated with the County and minimized during the morning and evening peak traffic periods.
- Traffic control devices shall be installed as specified in the California Department of Transportation's *Manual of Traffic Controls for Construction and Maintenance Works Zones* (California Department of Transportation 1996). Flaggers shall be used as necessary for directional traffic controls.
- The maneuvers of construction vehicles shall not block or restrict the movement of adjacent traffic flows within the construction zone.
- Safe pedestrian and bicyclist access shall be maintained in or around the construction areas at all times. Construction areas shall be secured as required by the applicable jurisdiction to prevent pedestrians and bicyclists from entering the work site. Alternate routes shall be provided for bicyclists and pedestrians during ~~sidewalk,~~ bike lane~~,~~ and recreation trail closures. Notification shall be provided to the public of temporary closures of ~~sidewalks,~~ bike lanes~~,~~ and recreation trails.
- As part of the traffic control plan, a detailed construction traffic management plan shall be developed to reduce the impacts of construction and employee traffic during construction. The plan shall address such issues as employee parking and truck and equipment circulation around the work site. Written notification will be provided to all contractor employees regarding appropriate routes to and from the construction site, and the weight and speed limits on local roads used to access the construction site;
- The traffic control plan shall clearly identify staging areas, dump sites, operating hours, including the hours during which trucks will be traveling State Routes, project duration, scheduling and phasing. It shall also identify the total number of construction vehicles and their respective haul routes, with hauling to be allowed on state routes only during off-peak hours.

- A notification plan shall be developed to notify business and residents in the construction area prior to onset of construction, as well as anyone else who may be affected by project construction. Signs will be posted at the construction site giving the name and telephone number or e-mail address of the NPS or County staff person designated to receive complaints regarding construction traffic.
- Access to adjacent development in or near the construction areas shall be maintained at all times. Provisions for traffic control shall be made to allow primacy for emergency vehicles. During non-construction times, all trenches and other construction features shall be covered to allow safe access to adjacent development.
- Response times for police, fire, and emergency services could be temporarily affected by the project, thereby increasing the potential for property losses or hazards to human health. Coordination with these agencies shall be completed as part of development of the traffic control plan, and these service providers shall be notified prior to onset of construction to reduce the potential for property losses and hazards to human health. Priority access shall be given to emergency service vehicles on Pacific Way.
- Roadway damage, such as potholes, minor fractures, will be repaired, and the overall roadbed will be maintained within the construction areas, to the extent that such damage is caused by project traffic that occurs during the period of hauling operations. Following construction within a particular roadway segment, roadway restoration shall take place within six weeks of completion of construction. County Design Guidelines shall be adhered to when reconstructing County roads. Agreements on restoration standards shall be formalized with the relevant jurisdiction (Marin County Public Works, and/or Caltrans), prior to the issuance of the work authorization permit.

Exhibit 2: Final Environmental Impact Statement

4.3.4.3 Aesthetics

Guiding Regulations and Policies

Federal Regulations

The Federal Highway Administration's (FHWA) *Visual Impact Assessment for Highway Projects* (Federal Highway Administration 1983) includes well-established policies, guidelines, and criteria for visual landscape relationships. These criteria form the basis of an objective methodology that is commonly used to establish the visual characteristics and quality of landscapes and to assess impacts on scenic vistas and scenic resources under NEPA. The concepts of vividness, intactness, and unity, each with a high and low quality, comprise the FHWA criteria.

Volume 2 of the U.S. Forest Service's *National Forest Landscape Management* Agriculture Handbook Number 462 (U.S. Forest Service 1974) also includes widely used criteria for visual resource analysis. To identify the importance of views of a resource, a viewshed must be broken into distance zones of foreground, middleground, and background. Generally, the closer a resource is to the viewer, the more dominant it is and the greater its importance to the viewer. Although distance zones in viewshed may vary between different geographic region or types of terrain, the standard foreground zone is 0.25–0.5 mile from the viewer, the middleground zone extends from the foreground zone to 3–5 miles from the viewer, and the background zone extends from the middleground to infinity.

The NPS Organic Act of 1916 states that NPS:

> …shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations…by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the **scenery** and the natural and historic objects and the wildlife therein…

Section 1.4.6 of the NPS Management Policies (National Park Service 2006a) describes the "park resources and values" that are subject to the NPS no-impairment standard. Included among these are a park's "scenery, scenic features, natural visibility, both in daytime and at night, and natural landscapes."

In Chapter 4 of the NPS Management Policies, scenic views are described as highly valued characteristics of the natural resources, processes, systems, and values found in national parks. Although this document contains no explicit guidance and policies related to aesthetics or scenic views in NPS lands, all guidance and policies related to management, preservation, and restoration of natural resources, processes, systems, and values within NPS lands inherently pertain to scenic views and the aesthetics of those lands. For example, Section 4.7.1, *Air Quality*, directs NPS to "perpetuate the best possible air quality in

parks to (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas."

Related to light and shadows, Section 4.10 of the NPS Management Policies (National Park Service 2006a) states that "the Service will preserve, to the greatest extent possible, the natural lightscapes of parks, which are natural resources and values that exist in the absence of human-caused light." The *Interim Technical Guidance on Assessing Impacts and Impairment to Natural Resources* (National Park Service 2003) also does not contain explicit guidance on scenic views or aesthetics, but it does provide extensive guidance on lightscapes.

State Regulations

The entire segment of Hwy 1 in Marin County is an eligible state scenic highway under the Caltrans Scenic Highway Program. The Guidelines for the Official Designation of Scenic Highways (Caltrans 1996) states that the scenic corridors (defined as the area of land generally adjacent to and visible from the highway) of officially designated state scenic highways are subject to protection, including regulation of land use, site planning, advertising, earthmoving, landscaping, and design and appearance of structures and equipment. Examples of visual intrusions that would degrade scenic corridors as stipulated by Caltrans and that are applicable to this project include dense and continuous development, highly reflective surfaces, development along ridge lines, extensive cut and fill, scarred hillsides and landscape, exposed and unvegetated earth, and a dominance of exotic vegetation.

The proposed project is located in the California Coastal Zone. The Coastal Act requires that its goals and policies be carried out by local government through the Local Coastal Program (LCP) process. Each local jurisdiction with land in the coastal zone is required to prepare an LCP, which contains a land use plan and land use regulations that implement the provisions of the Coastal Act. The CCC works with local governments to shape each LCP and ensure that they conform to Coastal Act goals and policies. The Marin County LCP (Marin County 1980) refers to visual resource protection policies in the Coastal Act that address the importance of protection of views to scenic resources from public roads, beaches, trails, and vista points.

Local Regulations

The Redwood Creek Watershed Vision (Department of Fish and Game et al. 2003), developed by a consortium of public agencies, outlines guiding principles to support future planning and projects in the watershed. One of these guiding principles is, "The natural beauty and rustic character of the landscape is maintained."

The *Marin Countywide Plan* (Countywide Plan; adopted 1994) provides for the long-range direction and development of land within the County. According to the plan, visual and aesthetic resources, especially scenic vistas, shall be protected by review of planned projects and removal of inconsistent existing elements. The following policies are relevant to the project:

Policy EQ-2. 72, Viewshed Protection. The County shall protect visual access to the bay front and scenic vistas of water and distinct shorelines through its land use and development review procedures.

Policy EQ-2. 73, View Corridor Identification and Enhancement. Existing built elements, such as overhead utilities, which detract from the shoreline and marsh landscape should be eliminated or blended into the environment. Sites with opportunities for near and distant views of the bay front and bay should be identified, protected and enhanced by improvements (turnouts, benches, etc.) where possible. View corridors and a low profile should be maintained on adjoining sites as well.

Study Area

The study area includes the entire project area and surrounding land uses, as well as the fill disposal haul routes.

Analysis Thresholds

The following thresholds, which are based on NPS management objectives, were used to determine impacts on aesthetics.

- **Negligible:** Would result in little or no detectable change in visual character or views of the site.
- **Minor:** Changes to the visual character and views of the site would be detectable, but the landscape has the capability to visually absorb and incorporate most of the changes. Would not appreciably alter important landscape characteristics, and view intactness would change only slightly, so as to not negatively affect scenic quality.
- **Moderate:** Changes to the visual character and views of the site would be readily noticeable. One or more secondary features of views of the site would be altered, but effects would be short-term and/or the keystone features of views would remain intact.
- **Major:** Changes to the visual character and views of the site would be highly noticeable, severe, and long-term, such that the original, pre-project landscape would be altered beyond recognition. Keystone features of views would change.

Methodology and Assumptions

The approach for this visual assessment is adapted from the FHWA's visual impact assessment system (Federal Highway Administration 1983) in combination with other established visual assessment systems. The visual impact assessment process involves identification of the following:

- relevant policies and concerns for protection of visual resources;
- visual resources (i.e., visual character and quality) of the region, the immediate action area, and the project site;
- important viewing locations (e.g., roads) and the general visibility of the action area and site using descriptions and photographs;
- viewer groups and their sensitivity; and
- potential impacts.

The degree of impact considered both the magnitude of change in the visual resource (i.e., visual character and quality) and viewers' responses to and concern for those changes. This general process is similar for established federal procedures of visual assessment (Smardon et al. 1986).

The following methods and assumptions were used to identify the area's existing visual resources and conditions.

- The visual features (visual resources) of the landscape were objectively identified using the FHWA guidelines (1983) discussed above.
- The character and quality of those resources relative to overall regional visual character were determined using the same FHWA guidelines.
- The importance to people, or *sensitivity*, of views of visual resources in the landscape was determined, based on the FHWA (1983) and USFS (1974) guidelines.

To determine impacts, the following methods and assumptions were used to evaluate changes that could occur with implementation of the alternatives.

- Direct field observation was conducted from multiple vantage points, including neighboring property and roadways (conducted February 3, 2005, and June 1, 2006).
- Photographs were reviewed of key views of and from the project site, as well as of regional visual context.
- State and local ordinances and regulations and professional standards pertaining to visual quality were reviewed.
- To identify the importance of views in the project area, the viewshed was broken into distance zones of foreground, middleground, and background.

Individual impacts were considered to be those that would result in direct or indirect changes to the visual character of Muir Beach and views of Muir Beach. Cumulative impacts were considered to be those that would contribute to changes in the visual landscape of the Muir Beach and Muir Woods area, views from Hwy 1, or the larger viewshed of the Marin Headlands.

Restoration Alternatives

Table 4.3.4.3-1 summarizes the potential impacts of the Restoration Alternatives to aesthetics. The Restoration Alternatives are described in Chapter 2.

Table 4.3.4.3-1. Potential Aesthetic Impacts from Restoration Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				
Impact	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	Mitigation Measure
AES-R1: Alteration of Scenic Views and Existing Visual Character During Construction Activities	Minor Adverse	**Moderate Adverse/ Moderate Adverse**	**Moderate Adverse/ Moderate Adverse**	**Moderate Adverse/ Moderate Adverse**	Impacts unavoidable as part of alternative implementation
AES-R2: Decreased Visual Quality During Site Recovery and Plant Recolonization	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
AES-R3: Creation of New Visual Features on the Site	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	
AES-R4: Changes in the Broader Viewshed from Hwy 1 and Other Distant Vantage Points	Negligible	Minor Beneficial	Moderate Beneficial	Moderate Beneficial	
AES-R5: Replacement of Nonnative Vegetation with Native Plant Communities	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	

Impact AES-R1: Alteration of Scenic Views and Existing Visual Character During Construction Activities (Short-Term, Year 0)

Construction activities create temporary changes in views of and from the project area. Construction activities would introduce considerable heavy equipment, including dozers, graders, scrapers, and trucks, into the viewshed of various viewer groups. Safety and directional signage would also be a visible element. Site preparation, the presence of heavy equipment, exclusion fencing, staging, and construction activities can result in substantial short-term changes to the existing visual character and views of the site from Hwy 1 and nearby overlooks, trails, and properties. Vegetation would be temporarily removed in some areas to allow equipment access; some unsightly construction access routes through the Green Gulch pasture and the alder grove upstream of Pacific Way would be constructed for heavy equipment.

Restoration Alternative 1: Minor Adverse. Periodic creek dredging activities would be necessary under the No Action alternative, and, due to the presence of heavy equipment, would alter the visual quality of the site. However, due to the infrequent and short-term nature of such activities, adverse impacts are considered minor.

Restoration Alternative 2, 3, 4: Moderate Adverse. The location, type, extent, and duration of construction would vary somewhat by alternative, but the resulting impacts would be similar. The primary difference between the alternatives would be the duration and extent of construction activities. Alternative 2 would have the smallest construction footprint and would consist 3 years of construction. Alternatives 3 and 4 would be conducted on a larger portion of the site, and would result in 4 years of construction.

Nearby residences would have construction occurring adjacent to their homes, and the visual character of their homes would be affected during construction times. Visitors and recreationists to the project area would be subjected to construction-related activities, as would those traveling on Hwy 1. Construction is scheduled from April through October, which coincides with the busy summer vacation season. Impacts to roadway users would be minor due to short intervals of time that they are in visual contact with the project site at normal roadway speeds. Even though all viewer groups are affected, construction views are temporary.

In addition to the impacts associated with the restoration, the interim flood reduction measures would also have minor aesthetic impacts similar to those described above for the No Action alternatives.

Overall, impacts are considered to be moderately adverse and significant. Because construction activities are an unavoidable part of implementation of any of the alternatives, impacts are considered significant and unavoidable.

Impact AES-R2: Decreased Visual Quality During Site Recovery and Plant Recolonization (Short-Term, Year 5)

Restoration Alternative 1: Negligible. Periodic maintenance dredging is anticipated to result in minimal disturbance to vegetation and is expected to have negligible impacts in the years following the actions.

Restoration Alternative 2, 3, 4: Minor Adverse. Following the completion of construction under all action alternatives, plant communities will take time to recover and mature. In the short term after construction, areas where native or nonnative vegetation or human-made features were removed would be immediately revegetated, but they would appear somewhat barren and artificially planted, which would reduce the quality of the natural appearance of the site. Although all viewer groups would be affected by the vegetation, this effect on the visual character of the site would be temporary. Over time, natural recruitment along with planting would revegetate these areas with an appropriate balance of native vegetation.

The interim flood reduction measures that are common to all alternatives are anticipated to result in minimal disturbance to vegetation and are expected to have minor impacts in the years immediately following the actions.

Impact AES-R3: Creation of New Visual Features on the Site (Long-term, Year 50)

New features associated with the restoration actions, such as the relocated creek, removal of the levee road, naturalization of the currently channelized tributaries, and other elements common to all action alternatives, would be noticeable changes to the visual environment. The restoration actions would result in increased integration of vegetation communities across the landscape. Increases in riparian extent will support increased numbers of songbirds, and their songs and nesting activities would bring an enlivening, aesthetically appealing quality to the site. The visual changes resulting from restoration of the site's natural ecological and geomorphic functions, and the resulting increased ecological complexity and integrity, are generally expected to be perceived as positive changes in visual quality. Under all of the Restoration Alternatives, the rustic character of the site would be maintained, although some of the features that are thought to contribute to this character would be removed, such as old fence posts and the cattle chute adjacent to Pacific Way.

Restoration Alternative 1: Negligible. There would be no permanent site modifications; therefore, current visual character at the site would persist.

Restoration Alternative 2: Moderate Beneficial. The interim flood reduction measures that are common to all alternatives would not result in any permanent site modifications. However, the restoration actions associated with this alternative would have positive effects as described above.

Restoration Alternative 3: Moderate Beneficial. The interim flood reduction measures that are common to all alternatives would not result in any permanent site modifications. However, the restoration actions would have positive effects as described above. In particular, new features associated with the restoration actions, such as the two small lagoons that would be created at the site, would represent a substantial change to the visual environment at the site.

Restoration Alternative 4: Moderate Beneficial. The interim flood reduction measures that are common to all alternatives would not result in any permanent site modifications. However, the restoration actions would have positive effects as described above. The restoration actions under Alternative 4 would represent the greatest change to the visual environment of the site. The large lagoon would be a prominent new feature.

Impact AES-R4: Changes in the Broader Viewshed from Hwy 1 and Other Distant Vantage Points (Long-Term, Year 50)

Distant views of the site from Hwy 1 and nearby overlooks, trails, and properties would be altered by all the action alternatives. In general, these changes to the scenic quality of views are expected to improve for viewers familiar with the restored nature of the site. For viewers not familiar with the restoration, the

quality of views is not anticipated to change substantially because the rural, undeveloped nature of the site would not change.

Restoration Alternative 1: Negligible. From Hwy 1, roadway users have middleground views of the project site. There are no site modifications in this alternative; therefore, current views of the site would persist, and the overall viewshed from more distant vantage points would not change.

Restoration Alternative 2: Minor Beneficial. The interim flood reduction measures that are common to all alternatives would not likely be visible from Hwy 1 or other distant vantage points. Under the restoration, site features would be generally similar to the No Action Alternative for distant viewers, although an increase in riparian forest extent would be evident as opposed to the existing views of degraded wetland vegetation under the No Action Alternative.

Restoration Alternative 3: Moderate Beneficial. The interim flood reduction measures that are common to all alternatives would not likely be visible from Hwy 1 or other distant vantage points. Under the restoration, distant views of the site from Hwy 1 and nearby overlooks, trails, and properties would be altered from a generally vegetated area to two small water bodies with surrounding wetland and riparian vegetation.

Restoration Alternative 4: Moderate Beneficial. The interim flood reduction measures that are common to all alternatives would not likely be visible from Hwy 1 or other distant vantage points. Under the restoration, distant views of the site from Hwy 1 and nearby overlooks, trails, and properties would be significantly altered from a generally vegetated area to open water with surrounding wetland vegetation.

Impact AES-R5: Replacement of Nonnative Vegetation with Native Plant Communities (Long-term, Year 5 and 50)

Restoration Alternatives 1: Negligible. There would be no site modifications; therefore, current visual character of nonnative vegetation at the site would persist.

Restoration Alternatives 2, 3, and 4: Moderate Beneficial. All action alternatives would support recovery of native plants by removing invasive nonnative plant species. In particular, cape ivy, Himalayan blackberry, and nonnative invasive perennial grasses, such as kikuyu grass, Harding grass, and tall fescue, would be removed from various locations at the project site. This would enhance the overall visual appeal of the site.

Public Access Alternatives

Table 4.3.4.3-2 summarizes the potential impacts of Public Access Alternatives to aesthetics in the study area. These alternatives are described in detail in Chapter 2.

Table 4.3.4.3-2. Potential Aesthetic Impacts from Public Access Alternatives

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
AES-P1: Alteration of Scenic Views and Existing Visual Character During Construction Activities	Negligible	**Moderate Adverse**	**Moderate Adverse**	**Moderate Adverse**	**Moderate Adverse**	**Moderate Adverse**	**Moderate Adverse**	
AES-P2: Creation of New Visual Features at Parking Lot Site and Change in Views from Hwy 1 and Other Distant Scenic Vantage Points	Negligible	Moderate Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Adverse	Minor Adverse	
AES-P3: Maintenance of Rustic Character of the Site	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	Minor Beneficial	
AES-P4: Change in Light and Glare	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor Adverse	

Impact AES-P1: Alteration of Scenic Views and Existing Visual Character During Construction Activities (Short-Term, Year 0)

Impact mechanisms would be similar to those described under Impact AES-R1.

Public Access Alternative A: Negligible. There would be no construction activities in the parking lot. Existing parking lot, visitor facilities, and access routes would not change.

Public Access Alternative B1, B2, B3, B4, B5, C: Moderate Adverse. Motorists would not be greatly affected by the construction activities because the parking lot is not visible from Hwy 1. Visitors to Muir Beach and recreationists would have a disrupted view of and from the parking lot area. Residents of the project area would be affected by this change in visual quality, although this effect would vary in degree depending on the location of their home and their sensitivity. In particular, Alternatives B4 and B5, due to their orientation, would

have more visual impacts for the residents on Pacific Way that are closest to the parking lot because more construction equipment would be working in front of their homes. Under Alternative C, construction activities at Alder Grove, a currently undeveloped site adjacent to Hwy 1, would be in the immediate viewshed of motorists traveling on Hwy 1. However, there would be a 25-foot deep screen of trees separating the road from construction activities.

Construction activities would adversely impact most viewer groups. However, these activities are temporary, and would be shorter in duration and of lesser intensity than the Restoration Alternatives. Impacts are therefore considered moderate but less than significant.

Impact AES-P2: Creation of New Visual Features at Parking Lot Site and Change in Views from Hwy 1 and Other Distant Scenic Vantage Points (Long-Term, Years 5 and 50)

The various sizes, configurations, and locations of the parking lots would affect how they are perceived visually and which viewer groups would be affected. Motorists would not be greatly affected by the parking lots because they would not be visible from Hwy 1 (with the exception of Public Access Alternative C).

All actions alternatives include dense native tree cover and/or herbaceous vegetation in 5-foot wide planting bays (swales) between the rows of parking and in planting islands separating groups of vehicles. Immature vegetation would not provide substantial visual benefits in the short term, but once mature, this vegetation would camouflage the parking lot and further improve the quality of views. Similarly, for parking lot alternatives that would result in areas of new riparian habitat in the area formerly occupied by the existing parking, immature riparian vegetation would appear somewhat barren and artificially planted, reducing the quality of the natural appearance of the site somewhat in the short term until vegetation matures (5–10 years), resulting in long-term visual benefits.

Public Access Alternative A: Negligible. Current visual character and views of the parking lot would persist. The existing parking lot is not visible from Hwy 1.

Public Access Alternative B1: Moderate Beneficial. The parking lot would have the same orientation as under the No Action Alternative, but would be less than half the size. The reduced size of the lot would result in some areas of new riparian habitat, with both the short-term and long-term implications as described above. Overall, the reduced prominence of the parking lot, the presence of increased extent of riparian habitat, and the planting bays in the lot would improve the aesthetic value of the site for all viewer groups and would have a positive effect on the natural, undeveloped setting of the site.

Public Access Alternative B2: Minor Beneficial. The parking lot size and configuration under Alternative B2 would be the most similar to existing conditions, and views of the lot would not change substantially. However, the planting bays in the lot would improve the aesthetic value of the site for all viewer groups and would have a positive effect on the natural, undeveloped setting of the site.

Public Access Alternative B3: Minor Beneficial. This alternative parking lot size would be about the same size as the existing lot. The planting bays in the lot would improve the aesthetic value of the site for all viewer groups and would have a positive effect on the natural, undeveloped setting of the site..

Public Access Alternative B4: Minor Beneficial. This alternative parking lot size is also slightly larger than the No Action Alternative, yet the lot would be reoriented along Pacific Way. For the residents in the Muir Beach community who have views from above, and for hikers on the hills to the east of the site, there will no longer be a protrusion into the landscape. Visitors of Muir Beach and residents alike will be able to experience a more contiguous landscape with the parking lot in this location. Residents on Pacific Way who are immediately adjacent would have their views shift from riparian habitat to a parking lot; however, there would be a vegetated buffer between Pacific Way and the parking lot which will help screen the parking lot from the residents' viewshed. The planting bays in the lot would also improve the aesthetic value of the site. Overall, impacts are considered minor beneficial.

Public Access Alternative B5: Minor Adverse. This parking lot alternative would have the largest footprint of any of the alternatives and would be aligned along a more substantial portion of Pacific Way. Residents on Pacific Way who are immediately adjacent would have their views shift from riparian habitat to a parking lot; however, there would be a vegetated buffer between Pacific Way and the parking lot which will help screen the parking lot from the residents' viewshed. In addition, the planting bays in the lot would improve the aesthetic value of the site. However, the overall increased prominence of the lot would adversely alter scenic views of the site and would have a negative effect on the natural, undeveloped setting of the site.

Public Access Alternative C: Minor Adverse. The parking lot at Alder Grove would require a previously undeveloped, vegetated site to be cleared. This would result in changes in visual character and views of the site, particularly for travelers on Hwy 1. The parking lot would be in the immediate viewshed of motorists as they travel past the site, though their exposure to it would be minimal at normal roadway speeds. There would be a 25-foot deep screen of trees along with the dense native tree cover and/or herbaceous vegetation as planned in the other alternatives. Also, the parking lot would not be paved or have any lighting installed.

Conversely, this alternative would improve the visual character and distant views of the existing Muir Beach parking lot site. The removal of the parking lot at the beach (with the exception of a small handicapped parking area and drop-off/turnaround area) would allow for a larger restoration area, reducing the human footprint and associated visual impacts. New riparian vegetation at this location would provide visual benefits once it matures. This would improve the aesthetic value of the site for all viewer groups.

Impact AES-P3: Maintenance of Rustic Character of the Site (Long-Term, Years 5 and 50)

Public Access Alternative A: Negligible. The natural, low-profile, rustic character of site details (i.e., signage, fencing, benches, pathways) would not change.

Public Access Alternative B1, B2, B3, B4, B5, C: Minor Beneficial. Under each Public Access Alternative, the existing rural setting would be preserved and enhanced. While certain site details will be removed during construction activities, the rustic character of the area will be retained. There are no major new structures planned, and features such as interpretive kiosks, signage, picnic area, boardwalks, and fencing will be designed to maintain a low profile. Construction materials will consist mainly of weathered wood that will blend with the natural, aesthetic setting of the area. The parking lot (under all alternatives) would be unpaved and no lighting is planned. The preservation and enhancement of the existing rural features at the site, in concert with restoration actions, would improve the existing visual character and natural setting.

Impact AES-P4: Change in Light and Glare (Long-Term, Year 50)

Public Access Alternative A: Negligible. There are no lights in the existing parking lot, and therefore there would be no change in light or glare at the site.

Public Access Alternative B1, B2, B3, B4, B5: Negligible. There would be no additional lighting installed in any of the action alternatives, nor will the parking lots be paved. Sunlight will reflect off the cars creating a source of glare, but the dense native tree cover and/or herbaceous vegetation in the swales and parking lot islands will eliminate much of this source of light. Also, because there is an existing parking lot, viewer groups already experience glare from the cars parked there.

Public Access Alternative C: Minor Adverse. The remote parking lot planned for this alternative is located on a previously undeveloped, vegetated site along Hwy 1. The sunlight reflected off of cars parked in this lot could be a nuisance for travelers on Hwy 1. However, there would be a 25-foot buffer of trees separating the parking lot from the road. In addition, as mentioned above, planting bays in the parking lot would be installed. Both of these would remove much of the glare from the cars. Furthermore, effects to roadway users would be minor due to short intervals of time that they are in visual contact with the project site at normal roadway speeds.

Bridge Alternatives

Table 4.3.4.3-3 summarizes the potential impacts of Bridge Alternatives to aesthetics in the study area. The Bridge Alternatives are described in Chapter 2.

Table 4.3.4.3-3 Aesthetic Impacts of Bridge Alternatives

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					Mitigation Measure
	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	
AES-B1: Alteration of Scenic Views and Existing Visual Character During Construction Activities	Negligible	**Moderate Adverse**	**Moderate Adverse**	**Moderate Adverse**	**Moderate Adverse**	
AES-B2: Creation of New Visual Features on the Site	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Moderate Adverse	
AES-B3 Change in Light and Glare	Negligible	Negligible	Negligible	Negligible	Negligible	

Impact AES-B1: Alteration of Scenic Views and Existing Visual Character During Construction Activities (Short-Term, Year 0)

Impact mechanisms would be similar to those described under Impact AES-R1.

Bridge Alternative BR0: Negligible. Current visual character and views of the bridge over Pacific Way would remain unchanged. There would be no construction activities.

Bridge Alternative BR1, BR2, BR3, BR4: Moderate Adverse. Residents who use Pacific Way as the access route to their homes would likely be the most affected because they would have to drive on the bypass road through this construction area on a regular basis. The number of visitors to the area would likely decrease during construction because of limited access, so a reduced number of visitors would experience the degraded views during construction. Patrons of the Pelican Inn would also be affected by these construction activities. Motorists on Hwy 1 would catch only fleeting glimpses of the construction.

Construction activities would adversely impact all viewer groups. However, these activities are temporary, would be shorter in duration and of lesser intensity than the Restoration Alternatives, and would be more similar to the impacts of the Public Access Alternatives. Impacts are therefore considered moderate but less-than-significant.

Impact AES-B2: Creation of New Visual Features on the Site (Long-Term, Years 5 and 50)

The existing bridge is not wide enough for two cars and has a deck height of approximately 15 feet NGVD. All action Bridge Alternatives would require dismantling the existing bridge and replacing it with a road. Under all alternatives, the new bridge would include a pedestrian path on the downstream side and would have open rails that minimize blockage of stream flows.

The bridge structure itself would represent an unnatural feature in the natural aesthetic landscape. All viewer groups would be affected by this change in visual quality, although the effect would vary in degree depending on the viewer location and sensitivity. The most affected would be the residents who use Pacific Way on a regular basis to access their homes. Because Pacific Way is the only road to the beach, visitors to Muir Beach would also be affected by the appearance of a new bridge structure. Visitors to the Pelican Inn would also see the new bridge. Motorists on Hwy 1 would catch only fleeting glimpses of the bridge.

The new bridge would be designed to blend with the natural environment and be consistent with the character of the landscape. The Marin County is dedicated to maintaining a natural, rustic feel to the local area and all bridge materials would reflect this commitment.

Bridge Alternative BR0: Negligible. There would be no site modifications; therefore, current visual character at the bridge site would persist.

Bridge Alternative BR1 and BR3: Minor Adverse. While these two bridges differ in the length of their span, both would have similar deck height and the total length of raised area (including the raised roadway) would be similar. While the new bridge would change views along Pacific Way, changes are not anticipated to be substantial, and would not substantially degrade the existing visual character of the site. Impacts are considered minor.

Bridge Alternative BR2: Minor Adverse. This bridge would have a deck height that is similar to existing conditions, and would not have a raised road, resulting in the smallest visual effects of any Bridge Alternative. However, the new bridge would still change views along Pacific Way. Changes are not anticipated to be substantial and would not substantially degrade the existing visual character of the site. Impacts are considered minor.

Bridge Alternative BR4: Moderate Adverse. This bridge would result in the highest deck height of any of the Bridge Alternatives. As such, it would have the most substantial effect on views of any Bridge Alternative. Impacts are considered moderate but less than significant.

Impact AES-B3: Change in Light and Glare at the Site (Long-Term, Years 5 and 50)

Bridge Alternative BR0, BR1, BR2, BR3, BR4: Negligible. Materials used to construct the bridge would be consistent with the National Park Service's desire to make the bridge low-profile and keeping with the rustic, natural feel of the area (i.e., weathered wood, nonreflective paint). No long-term effects from light or glare related to the new bridge would be expected for any viewer group.

Fill Disposal Alternatives

Table 4.3.4.3-4 summarizes the potential impacts of Fill Disposal Alternatives to aesthetics in the study area. The Fill Disposal Alternatives are described in Chapter 2.

Table 4.3.4.3-4. Potential Aesthetic Impacts from Fill Disposal Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail*	Mitigation Measure
AES-F1: Alteration of Scenic Views and Existing Visual Character During Hauling Trips and Fill Disposal Activities	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
AES-F2: Creation of New Visual Features on the Site	Moderate Beneficial	Negligible	NA	Minor Beneficial	Minor Beneficial	

Note: The analysis of the two trail alternatives only considers the effects of hauling the fill to the sites. For the coastal trail, impacts of using the fill to recontour the trail are also considered.

Impact AES-F1: Alteration of Scenic Views and Existing Visual Character During Hauling Trips and Fill Disposal Activities (Short-Term, Year 0)

The Restoration and Public Access Alternatives would generate various amounts of fill as a result of excavation during restoration and construction. All fill generated will be reused on site where possible; however, some offsite disposal would still be necessary. This requires hauling materials by truck to the fill disposal site. These haul trips would affect the visual character of the roads on which the trucks drive, but only temporarily.

All alternatives would involve the use of equipment to dispose/spread fill material at the disposal site.

Unused Reservoir Pit: Minor Adverse. The approximately 0.75-mile haul route to the Unused Reservoir Pit follows Hwy 1 north of Pacific Way, past the Muir Beach Overlook. Trucks would turn off of Hwy 1 onto a section of the Coastal Trail to reach the Unused Reservoir Pit. This truck traffic, as well as the fill disposal activities themselves, would adversely affect the visual character of this trail for hikers. Motorists on Hwy 1 and visitors to the area stopping at the Muir Beach Overlook or taking a scenic drive will also be negatively affected by the sight of haul trips.

Upper Banducci Field: Minor Adverse. This approximately 0.5-mile haul route follows Hwy 1 from Pacific Way to the gravel driveway adjacent to Redwood Creek and the Hwy 1 Bridge. The trucks would travel down this road to the fill site. The additional trucks on Hwy 1 would have a negative affect on visual resources for motorists and scenic drivers, as would those along Muir Woods Road, which has views of the site. There are several residences adjacent to the fill site that would be affected by the increased truck traffic and fill disposal activities.

Hamilton AFB Wetlands: Minor Adverse. The haul route to Hamilton AFB Wetlands is approximately 20 miles and follows Hwy 1 south from the site to Tam Junction in Mill Valley, then north on US-101 about 13 miles. The extra trucks on the roads may be discernible to motorists on Hwy 1 and US-101, but are not unexpected for the freeway.

Dias Ridge Trail: Minor Adverse. This approximately 2.5-mile haul route to the Dias Trail fill site follows Hwy 1 south to the intersection with Panoramic Highway. The additional trucks on Hwy 1 would have a negative affect on visual resources for motorists and scenic drivers.

Coastal Trail: Minor Adverse. The approximately 0.75-mile haul route to the Coastal Trail fill site would not require travel on public roads. Because only private motorists travel on these roads, most viewer groups would not be affected. Truck trips could be visible from a distance.

Impact AES-F2: Creation of New Visual Features on the Site (Long-Term, Years 5 and 50)

Unused Reservoir Pit: Moderate Beneficial. The Unused Reservoir Pit is a large hole that measures 204 feet long, 175 feet wide, with an average depth of 15 feet. The Unused Reservoir Pit is an unnatural looking feature on the landscape, and filing it in would improve the natural character of the site. In addition, the surface of the Unused Reservoir Pit would be revegetated with native vegetation. While the Unused Reservoir Pit is not visible from Hwy 1, hikers on the trail would experience beneficial effects as a result of the filling of this unnatural, man-made feature.

Upper Banducci Field: Negligible. Materials brought to this site would be spread evenly in the upper portion of Banducci Field. This would raise the elevation of the field in a way that would be barely susceptible to motorists who can see the site from Muir Woods Road. The adjacent residents would also have a negligible change to their view of the field.

Hamilton AFB Wetlands: N/A. Visual effects of the Hamilton Wetlands Restoration Project have been discussed in the Draft EIS/EIR for that project.

Dias Ridge Trail: Minor Beneficial. The fill brought to the Dias Ridge Trail would be used to recontour the trail in a sustainable alignment that would not be susceptible to continued erosion or gullying. This would be an aesthetic improvement for hikers using the trail.

Coastal Trail: Minor Beneficial. The fill brought to the Coastal Trail would be used to recontour the trail in a sustainable alignment that would not be susceptible to continued erosion or gullying. This would be an aesthetic improvement for hikers using the trail.

Mitigation Measures

No mitigation is required.

Exhibit 2: Final Environmental Impact Statement

4.3.4.4 Energy, Public Services, Utilities, and Service Systems

This section discusses the impacts of the proposed project to utilities and public services in the unincorporated Muir Beach community.

Guiding Regulations and Policies

National Parks Service Management Policies 2006

The NPS has designated the management policies related to energy, public services, utilities, and service systems for park facilities, as discussed in detail in Chapters 8 and 9 of NPS (2006a) and outlined below.

- *8.2.5.2 Emergency Preparedness and Emergency Operations*—An emergency preparedness program will be developed to ensure visitor and employee safety and protect resources and property. Each park will develop and maintain an emergency operations plan.
- *8.2.5.3 Search and Rescue*—NPS will make reasonable efforts to search for lost persons, and to rescue sick, injured, or stranded persons.
- *8.2.5.4 Emergency Medical Services*—An emergency medical services program will be maintained to provide transportation of the sick and injured, and provide emergency care. Local community emergency services may also be used.
- *8.3 Law Enforcement Program*—The NPS will make reasonable efforts to provide for the protection, safety, and security of park visitors, employees, and public and private property, and to protect the natural and cultural resources. The Department of the Interior's law enforcement code of conduct will be followed.
- *8*.6.4 *Rights-of-Way for Utilities and Roads*—A right-of-way permit allowing a utility to pass over, under, or through NPS property may be issued only pursuant to specific statutory authority, and generally only if there is no practical alternative to such use of NPS lands. Right-of-way permits may be issued for utilities, telecommunications, roads and highways, or petroleum-based pipelines after discussions with park staff and completion of an application process.
- *8.6.5 Access to Private Property*—The NPS will not prevent access to the private property of adjacent landowners or landowners within park boundaries, except where harm to park resources or values would occur.
- *9.1.3 Construction*—The NPS will incorporate sustainable principles and practices into park facilities and use best management practices for all phases of construction activity.
- *9.1.3.3 Borrow Pits and Spoil Areas*—The NPS will ensure that materials will be extracted and used only for in-park uses that would not impair park

resources or values and comply with applicable federal, state, and local requirements.

- *9.1.5.3 Utility Lines*—Where feasible, utility lines will be placed underground and will share a common corridor combined with transportation corridors.
- *9.1.6.1 Waste Management*—The NPS will integrate waste reduction, reuse, and recycling programs to minimize the generation and disposal of solid waste. All disposal of solid waste on lands and waters within the park system must comply with NPS regulations in 36 CFR Part 6 to ensure protection of air and water quality, natural and cultural resources, and visitor enjoyment.
- *9.1.7 Energy Management*—The NPS will conduct activities that use energy wisely and economically and adhere to all federal policies governing energy and water efficiency, and renewable resources.
- *9.1.8 Structural Fire Protection and Suppression*—The NPS will manage structural fire activities to protect and promote the safe and appropriate public enjoyment of resources.

Marin County Local Coastal Program

Local Coastal Program policies on public services are identified within Unit 1, which covers the community surrounding Muir Beach (Marin County 1980). The policies that relate to public services include a provision to ensure that roads, flood control projects, and utility service expansions be limited to the minimum necessary to serve development. In addition, policies to protect public access, including parking facilities, to Muir Beach are included in the program.

Marin Countywide Plan

Policies for public services are covered within the Community Facilities Element of the Marin Countywide Plan (Marin County 1994). The applicable policies are as follows:

- *Policy CF-5.6—Barrier-free Design*. Community facilities should be designed or rehabilitated to remove barriers to disabled persons.
- *Policy CF-5.7—Energy Criteria*. Energy efficiency and renewable energy use should be included as criteria for approving and designing capital improvement projects for all agencies and special districts.
- *Policy CF-5.8—Waste Management*. Continue to implement the 1992 Marin County Source Reduction and Recycling Element.
- *Policy CF-8—Telecommunications Facilities*. Ensure siting and design of telecommunication facilities is compatible with other land uses, minimizes visual impacts, minimized potential health risks, provides protection from vandalism and fire hazards, and minimizes impacts on adjacent uses.

In addition, the Environmental Hazards Element contains the following policies that relate to public services involving fire protection:

- *Policy EH-11.4—Fuel Breaks and Access Routes*. The local, state, and federal fire protection agencies are encouraged to collaboratively promote the maintenance of existing fuel brakes and emergency access routes for effective fire suppression.
- *Policy EH-11.5—Uniform Fire Code*. The County and all other fire protection agencies will implement the latest Uniform Fire Code.
- *Policy EH-11.7—Fire Safety Standards*. The County implements state fire safety standards for all new construction.

Note that while a new plan has been adopted, the policies in that plan are substantively similar to those given above.

Marin County Code

The Marin County Code includes regulations that cover energy, public services, and utilities for the County. Relevant sections of the code that relate to these topics include, Title 17 *Health and Sanitation*, Title 10 *Parks, Open Space, and Cultural Services*, Title 15 *Traffic*, Title 16 *Fire*, Title 18 *Sewers*, Title 19 *Buildings*, and Title 23 *Natural Resource*.

Marin County Operational Area Emergency Response Plan

The Marin County Sheriff's Office of Emergency Services manages emergency response for the county. This department implements the Marin County Operational Area Emergency Response Plan (Marin County 1993). The plan addresses response to extraordinary emergency situations associated with natural disasters, technological incidents, & national security emergencies in or affecting Marin County. The department's emergency response program implements the following functions: hazard identification and risk assessment, hazard mitigation, planning, communications and warning, operations and procedures, resource management, training, crisis communication, and public education.

Study Area

The study area for impacts is the project site, although facilities or services near the site are considered where appropriate (e.g., off-site fire stations).

Analysis Thresholds

The following issues, based on the NPS Management Policies and the Marin County Initial Study Checklist Form, were considered in the analysis of impacts related to energy, public services, utilities, or service systems:

- Project-related demand for existing energy sources, and/or conflicts with adopted policies or standards for energy use.

- Project-related demands or conflicts with fire protection, police protection, emergency services and plans, maintenance of public facilities, including roads, or other governmental services.
- Project-related demands or conflicts with power or natural gas, communications systems, local or regional water treatment or distribution facilities, sewer or septic tanks, or solid waste disposal.

The following thresholds were used in determining the significance of impacts to energy, public services, or utilities and service systems:

- **Negligible:** No effects on energy, public services, utilities, or service systems would occur, or the effects would be below or at low levels of detection.
- **Minor:** The effects on energy, public services, utilities, or service systems would be small but detectable, in a manner that would be noticeable to NPS staff and the public. In the case of adverse impacts, the project would affect utilities or public services, but would not result in substantial degradation of service.
- **Moderate:** The effects on energy, public services, utilities, or service systems would be readily apparent. Substantial adverse or beneficial changes would be noticeable to NPS staff and the public. In the case of adverse impacts, the project would result in short interruptions of utility services or substantial degradation in provision of public services such as fire protection response times.
- **Major:** The effects on energy, public services, utilities, or service systems would be readily apparent. Substantial adverse or beneficial changes would be noticeable to NPS staff and the public. In the case of adverse impacts, the project would result in prolonged interruptions of utility services or inability to provide public services such as fire protection.

Methods and Assumptions

Technical reports for the Marin Countywide Plan Update were the primary source for information on local agencies, municipalities, and companies, including the Muir Beach Community Services District, SBC Communications, AT&T, and Pacific Gas & Electric Company that may be impacted by the proposed project. Although utilities in the project area include freshwater distribution and treatment services, wastewater and sewage collection and treatment, telephone, gas, electricity, and solid waste, only those utilities that may have piping or cables that could interfere with project implementation were considered in depth in this section. These utilities include: freshwater distribution lines, telephone/power poles and lines, and the inactive Wheelwright well and associated electricity lines.

Restoration Alternatives

Table 4.3.4.4-1 summarizes the potential impacts of Restoration Alternatives to energy, public services, utilities, and service systems. The Restoration Alternatives are described in Chapter 2.

Table 4.3.4.4-1. Potential Public Services Impacts from Restoration Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				
Impact	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	Mitigation Measure
PS-R1: Increased Demand for Existing Energy Sources or Conflict with Adopted Policies or Standards for Energy Use	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
PS-R2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner	Negligible	Negligible	Negligible	Negligible	PS-MM-1: Employ Sustainable Building Practices
PS-R3: Increased Demand for or Conflicts with Fire or Police Protection, Public Facilities Maintenance, or Other Governmental Services	Negligible	Negligible	Negligible	Negligible	
PS-R4: Increased Demand for or Conflict with Utility Lines or Service Systems	Negligible	**Moderate Adverse** / Negligible	**Moderate Adverse** / Negligible	**Moderate Adverse** / Negligible	PS-MM-2: Maintain Utility Services
PS-R5: Increased Solid Waste Demands	Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	PS-MM-1

Impact PS-R1: Increased Demand for Existing Energy Sources or Conflict with Adopted Policies or Standards for Energy Use (Short- And Long-Term, Years 0, 5 and 50)

Currently, there is no electrical energy use at the proposed project site. Gas-powered equipment and portable generators would supply power for interim maintenance dredging activities and construction of the restoration project. After construction, the project would not require electricity or natural gas. Consequently, policies and standards adopted by the NPS and Marin County would not be affected by the project.

Restoration Alternative 1: Negligible. There would be minimal demand for energy and no conflicts with existing energy use policies or standards.

Restoration Alternatives 2, 3, 4: Minor Adverse. Energy would be required during project construction. However, the contractor would use gas-powered equipment and portable electricity generators, thus surrounding/regional energy users would not be affected by reduced energy supply. There would be no demand for energy or conflicts with existing energy use policies or standards after project construction.

Impact PS-R2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner (Long-Term, Years 0, 5 and 50)

The project site does not contain non-renewable resources such as oil, coal, old-growth timber, or minerals. Consequently, policies and standards adopted by the NPS and Marin County related to these resources would not be affected by the project. However, construction would require some use of non-renewable resources (e.g., energy, building materials). After the project is completed, no long-term non-renewable energy or resource use is anticipated.

Restoration Alternatives 1, 2, 3, 4: Negligible. Periodic maintenance dredging and the action alternatives would require some use of energy and resources to construct. However, such use would be small, and the effects would be at a low level of detection. Implementation of PS-MM-1 is recommended to help ensure impacts are negligible.

Impact PS-R3: Increased Demand for or Conflicts with Fire or Police Protection, Public Facilities Maintenance, or Other Governmental Services (Long-Term, Years 0, 5 and 50)

The restoration project would not attract additional visitors or residents to the project area, thus it is assumed the demand for public services, including park maintenance, and police and fire patrol, would remain unchanged.

Under all the action alternatives, access for police and/or fire protection would be provided at all times during construction.

Restoration Alternatives 1, 2, 3, 4: Negligible. There would be negligible impacts on existing public services from the Restoration Alternatives.

Impact PS-R4: Increased Demand for or Conflict with Utility Lines or Service Systems (Short-Term, Year 0)

Currently, running water and electricity are not used at the visitor parking area. Restroom facilities consist of portable toilets.

All action alternatives would include the removal and relocation of power and telephone lines along the Pacific Way and the levee road, the telephone box on Pacific Way, and a water line along Pacific Way belonging to the Muir Beach Community Services District. In addition, the unused Wheelwright well pump near Green Gulch tributary, and supporting utility lines and poles, would be removed.

The proposed project would not attract additional visitors or residents to the project area, thus it is assumed the demand for utilities and service systems would remain unchanged.

Restoration Alternative 1: Negligible. The existing utility lines would continue to service the local residents.

Restoration Alternatives 2, 3, 4: Moderate Adverse. Relocation of utility lines, the telephone box, and the MBCSD water line would potentially result in disruption of service to residents. This would be considered a significant impact. Implementation of mitigation measure PS-MM-2 to maintain utility services would reduce this potential impact to less than significant.

Impact PS-R5: Increased Solid Waste Demands (Short-Term, Year 0)

Waste material generated as part of project construction and interim maintenance dredging would be reused to the maximum extent possible. For instance, excavated fill material would be reused onsite as part of the restoration project. Excess fill material would be hauled to one of the fill disposal sites described in the project description, while vegetative material would be composted onsite or at the Upper Banducci Field fill disposal site.

However, some materials would need to be disposed of at a landfill. These potentially include the rock gabions in the Redwood Creek channel near the pedestrian bridge, the concrete lining of the Green Gulch tributaries, and other materials that are not earthen or vegetative. In addition, there may be other types of construction waste (e.g., trash generated by construction crews) that would need to be disposed of at a landfill.

As described in Chapter 3, *Affected Environment*, the Redwood Sanitary Landfill has an estimated remaining capacity of 12.9 million cubic yards, and is anticipated to have sufficient capacity through 2039. As such, sufficient capacity exists to accommodate waste generated as part of project construction.

Should materials needing disposal be determined to be hazardous, as defined by federal and state regulations, the wastes would be disposed of at a landfill(s) other than Redwood Sanitary Landfill that is permitting to accept hazardous

waste. The discussion of the potential need for disposal of hazardous materials is addressed in Section 4.3.4.5, *Human Health and Safety*.

Operation of the project is not anticipated to increase visitation, and so would not generate additional amounts of materials for disposal.

Restoration Alternative 1: Negligible. Periodic maintenance activities would not generate substantial volumes of waste that would need disposal of at a landfill.

Restoration Alternatives 2, 3, 4: Negligible. Construction of the three action alternatives would require some solid waste disposal. However, the volume of waste disposal is negligible considering available landfill capacity. Implementation of PS-MM-1 is recommended to help ensure impacts are negligible.

Public Access Alternatives

Table 4.3.4.4-2 summarizes the potential impacts of Public Access Alternatives to energy, public services, utilities, and service systems. The Public Access Alternatives are described in Chapter 2.

Table 4.3.4.4-2. Potential Public Services Impacts from Public Access Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							
Impact	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	Mitigation Measure
PS-P1: Increased Demand for Existing Energy Sources or Conflict with Adopted Policies or Standards for Energy Use	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
PS-P2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	PS-MM-1
PS-P3: Conflict with Emergency Response	Negligible	Moderate Adverse	Minor Adverse	Negligible	Negligible	Minor Beneficial	Minor Adverse	
PS-P4: Increased Solid Waste Demands	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	PS-MM-1

Impact PS-P1: Increased Demand for Existing Energy Sources or Conflict with Adopted Policies or Standards for Energy Use (Short-Term, Years 0, 5 and 50)

Impact mechanisms would be described as under Impact PS-R1.

Public Access Alternative A: Negligible. There would be no demand for energy or conflict with existing energy use policies or standards.

Public Access Alternatives B1 through B5 and C: Minor Adverse. Impacts would be similar to those described for the Restoration Alternatives under Impact PS-R1.

Impact PS-P2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner (Long-Term, Year 0)

Impact mechanisms would be the same as described under Impact PS-R2.

Public Access Alternative A: Negligible. As there would be no change from existing conditions, this alternative will not increase the use of non-renewable resources.

Public Alternatives B1, B2, B3, B4, B5, C: Negligible. The six action alternatives would require reconfiguration of the existing parking lot and installation of other public access amenities. The removal of existing facilities and the construction of the new public access features will require the use of some non-renewable resources (energy, building materials). However, such use would be small, and the effects would be at a low level of detection. Implementation of PS-MM-1 is recommended to help ensure impacts are negligible.

Impact PS-P3: Conflict With Emergency Response (Short- and Long-Term, Years 0, 5 and 50)

Currently, Pacific Way is the primary route for emergency response to residences, Muir Beach, and surrounding trails. The levee road is utilized for emergency access to southern areas of the beach and surrounding trails. During the peak visitor season, the parking lot becomes full and visitors tend to park on the shoulders of Pacific Way and adjacent roads. This congestion restricts emergency response access to local residents and recreational visitors.

Under all action alternatives, the proposed project would relocate the emergency access route to replace the levee road, which would be removed as part of the restoration. The new emergency access route would follow an existing trail along the southern and eastern border of the project area, terminating at the existing staging area near the beach. The proposed emergency route would be longer than the existing route, but would continue to allow for emergency access to both the east and west sides of Redwood Creek, surrounding trails, and Muir beach, and would not result in substantial changes in response times. The existing emergency access route via the levee road would not be removed until the new access route has been upgraded, thus emergency access would be available throughout project construction.

Under all the action alternatives, access for police and/or fire protection would be provided at all times during construction.

Public Access Alternative A: Negligible. No actions would be taken that would affect emergency response. Traffic congestion that occurs when parking demand exceeds supply (i.e., weekends during the peak season), and potential conflicts with emergency response, would continue.

Public Access Alternative B1: Moderate Adverse. Current constraints from parking overflow on emergency response to park visitors and residences would increase due to reduced number of parking spaces from 175 to 50, which would potentially result in increased congestion along Pacific Way and adjacent roads when parking demand exceeds supply (throughout the peak season and during the weekends of the shoulder and off-peak seasons). This is considered a moderate but less-than-significant impact.

Public Access Alternative B2: Minor Adverse. Current constraints on emergency response to the beach and residences would increase due to reduced number of parking spaces from 175 to 145, which would potentially result in

increased congestion along Pacific Way and adjacent roads when parking demand exceeds supply (throughout the peak season and during the weekends of the shoulder seasons).

Public Access Alternative B3 and B4: Negligible. Parking capacity would be the same as under existing conditions.

Public Access Alternative B5: Minor Beneficial. Current constraints on emergency response to the beach and residences would remain the same or potentially improve during the peak season. The increase of 25 additional parking spaces would potentially reduce the tendency for visitors to park along the shoulders of Pacific Way and adjacent roads, reducing traffic congestion during the weekends of the peak season.

Public Access Alternative C: Minor Adverse. While the remote location of the parking lot could redirect traffic away from Pacific Way, it is likely to increase congestion on Hwy 1. In addition, the small size of the lot (118 spaces) could result in parking overflow onto Pacific Way and surrounding streets. These sources of congestion would potentially hinder emergency response to incidents along Hwy 1 and Pacific Way.

In addition, the Alder Grove parking lot and extended pedestrian trails would present an additional high-use area, which would require attention from local emergency response agencies. Consequently, emergency situations would potentially be spread over a larger area compared to existing conditions. However, the entire project area, including the Alder Grove site, is currently serviced by emergency response agencies, thus service would not be significantly affected by this alternative.

Impact PS-P4: Increased Solid Waste Demands (Short-Term, Year 0)

Impact mechanisms would be described as under Impact PS-R5.

Public Access Alternative A: Negligible. No actions would be taken that would generate waste.

Public Access Alternatives B1, B2, B3, B4, B5, C: Negligible. Construction of the action alternatives would require some solid waste disposal. However, the volume of waste disposal is negligible considering available landfill capacity. Implementation of PS-MM-1 is recommended to help ensure impacts are negligible.

Bridge Alternatives

Table 4.3.4.4-3 summarizes the potential impacts of Bridge Alternatives to energy, public services, utilities, and service systems in the study area. The Bridge Alternatives are described in Chapter 2.

Table 4.3.4.4-3. Potential Energy, Public Services, Utilities, and Service Systems Impacts from Bridge Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	Mitigation Measure
PS-B1: Increased Demand for Existing Energy Sources or Conflict with Adopted Policies or Standards for Energy Use	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
PS-B2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner	Negligible	Negligible	Negligible	Negligible	Negligible	PS-MM-1
PS-B3: Conflict with Emergency Response During Project Construction	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
PS-B4: Conflict with Emergency Response Throughout the Lifetime of the Project	**Moderate Adverse**	Moderate Beneficial	Minor Beneficial	Moderate Beneficial	Major Beneficial	BR0: No mitigation available

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					Mitigation Measure
	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	
PS-B5: Increased Demand for or Conflict with Utility Lines or Service Systems	Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	PS-MM-2
PS-B6: Increased Solid Waste Demands	Negligible	Negligible	Negligible	Negligible	Negligible	PS-MM-1

Impact PS-B1: Increased Demand for Existing Energy Sources or Conflict with Adopted Policies or Standards for Energy Use (Long-Term, Years 0, 5 and 50)

Impact mechanisms would be described as under Impact PS-R1.

Bridge Alternatives BR0: Negligible. There would be no demand for energy or conflict with existing energy use policies or standards.

Bridge Alternatives BR1, BR2, BR3, BR4: Minor Adverse. Impacts would be similar to those described for the Restoration Alternatives under Impact PS-R1.

Impact PS-B2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner (Cumulative, Long-Term, Year 0)

Impact mechanisms would be described as under Impact PS-R2.

Bridge Alternative BR0: Negligible. As there would be no change from existing conditions, this Bridge Alternative will not increase the use of non-renewable resources. The current function and condition of the bridge would need to be maintained with minor repairs and retrofits, but the demand for non-renewable supplies would be limited.

Bridge Alternatives BR1, BR2, BR3, BR4: Negligible. These four Bridge Alternatives would require the replacement the existing bridge. The demolition of the existing bridge and the construction of the new roadway and bridge will require use of non-renewable resources. Although the bridge has yet to be designed, it will likely include non-renewable materials such as steel, copper, petroleum products and concrete. Its construction will require the use of poured in place reinforced concrete, the fabrication of steel members and integrated structural parts, and surfacing of the roadway. Furthermore, a wide variety of gas-powered tools, machinery and vehicles will be employed to carry out the construction. However, use of such materials would be small, and the effects would be at a low level of detection. Implementation of PS-MM-1 is recommended to help ensure impacts are negligible.

Impact PS-B3: Conflict with Emergency Response During Project Construction (Short-Term, Year 0)

Construction activities associated with the new Pacific Way Bridge and temporary bypass road south of Pacific Way could delay emergency response times. However, the bypass road would allow for vehicle access until the new bridge is constructed. Additionally, visitor access to Muir Beach and surrounding trails would be restricted during certain phases of construction, potentially reducing the need for emergency response to recreational visitors during construction.

Bridge Alternative BR0: Negligible. No construction would occur.

Bridge Alternative BR1, BR2, BR3 and BR4: Minor Adverse.

Impact PS-B4: Conflict with Emergency Response Throughout the Lifetime of the Project (Long-Term, Years 5 and 50)

Access to Pacific Way and the levee road, which are the emergency access routes on the site, is blocked during high rainfall events when Pacific Way becomes flooded due to out-of-bank flows from Redwood Creek. All of the new Bridge Alternatives would result in a bridge that is less frequently subject to inundation. The frequency and duration of bridge inundation is was calculated using hydraulic modeling performed by PWA (Appendix D), as shown on Table 4.3.4.4-4.

Table 4.3.4.4-4. Depth and Duration of Inundation of Modeled Bridge Alternatives Under Various Design Storm Events

Flow Event:			5 Year			10 Year			100 Year[5]	
Bridge Alternative	Span (feet)	Deck/Road Elevation (feet NGVD)	WSE[1] (feet NGVD)	Depth at Road[2] (inches)	Approximate[4] Duration (hours)	WSE[1] (feet NGVD)	Depth at Road[2] (inches)	Approximate[4] Duration (hours)	WSE[1] (feet NGVD)	Depth at Road[2] (inches)
BR1	50	15.5	~15.5	N/A[3]	0	15.8	3	11.5	16.6	12
BR2	50	11-15	13.1	25	27	13.6	31	27	15.9	~60
BR3	150	14.5	14.7	~3	5.5	~15.1	~5	11.5	~17	30
BR4	266-300	18	Bridge would not be overtopped during 5-year, 10-year or 100-year event.							

Source: Appendix D, Table 7.

Notes:

1. WSE = Water Surface Elevation. Average water surface elevation across the raised road. Water levels vary by up to 0.4 feet across the 50 foot–wide road embankment.
2. Maximum depth (in inches) at road, based on averaging the maximum water depths along the entire road profile.
3. N/A = not applicable. No overtopping of road.
4. Approximate duration that any water would overtop the road, including periods of shallow flooding. Maximum depth at road would only occur during a portion of this period. Does not account for conditions that may extend flooding duration, such as tidal effects.
5. Analysis was not conducted to estimate the duration of 100-year flood events.

In addition, the new bridge would be widened to allow for 2-way traffic, reducing the potential conflicts for emergency service vehicles.

Bridge Alternative BR0: Moderate Adverse. Flooding of the existing bridge impedes access during times of high runoff, several times every winter. Also, on heavily visited weekends when Pacific Way supports heavy traffic volumes and spillover parking, the one-lane bridge creates a bottleneck to limit the speed of emergency response.

This constraint on emergency access is anticipated to cumulatively continue to worsen as flooding conditions at the Pacific Way crossing of Redwood Creek increase in severity due to sedimentation of the creek and surrounding area. The resulting increased size and duration of flooding along Pacific Way would further impair emergency access to residences and the surrounding area.

This is considered a significant and unavoidable consequence of the No-Action Alternative.

Bridge Alternative BR1: Moderate Beneficial. Under this alternative, the bridge and associated roadway would be passable during most storm events. During the 10-year event, the road would be overtopped for approximately 11.5

hours, with a maximum depth of 3 inches. During the 100-year event, the depth on the road/bridge could reach as much as 12 inches, which could be impassible for many vehicles.

Bridge Alternative BR2: Minor Beneficial. Under this alternative, the frequency of inundation of the roadway/bridge would be reduced, but the roadway would be impassible during 5-year and larger storm events with water depths on the roadway of greater than 2 feet, and total duration of roadway inundation exceeding one day.

Bridge Alternative BR3: Moderate Beneficial. Under this alternative, the bridge and associated roadway would be passable during most storm events, although shallow overtopping could occur for up to 5.5 and 11.5 hours during the 5-year and 10-year storm events, respectively. During the 100-year event, the road/bridge would be impassible with a water depth of as much as 30 inches.

Bridge Alternative BR4: Major Beneficial. Under this alternative, the bridge and associated roadway as modeled would not be inundated and would remain passable during the 100-year and smaller storm events. The redesigned bridge would provide passage for conditions between Alternative BR3 and Alternative BR4 (as modeled). The bridge would span a very large magnitude event (i.e., much larger than a 10-year event and probably as close as possible to a 100-year event). Its ultimate capacity would be determined during project design, when other design constraints can be fully considered simultaneously by bridge engineers.

Impact PS-B5: Increased Demand for or Conflict with Utility Lines or Service Systems (Short-Term, Years 0)

The impacts of relocation of utilities associated with the bridge have been previously discussed under Impact PS-R4.

Impact PS-B6: Increased Solid Waste Demands (Short-Term, Year 0)

Impact mechanisms would be described as under Impact PS-R5.

Bridge Alternative BR0: Negligible. No actions would be taken that would generate waste.

Bridge Alternatives BR1, BR2, BR3, BR4: Negligible. Construction of the action alternatives would require some solid waste disposal, including demolition and disposal of the existing bridge. However, the volume of waste disposal is negligible considering available landfill capacity. Implementation of PS-MM-1 is recommended to help ensure impacts are negligible.

Fill Disposal Alternatives

Table 4.3.4.4-5 summarizes the potential impacts of Fill Disposal Alternatives to energy, public services, utilities, and service systems in the study area. The Fill Disposal Alternatives are described in Chapter 2.

Table 4.3.4.4-5. Public Services Impacts from Fill Disposal Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail[1]	Mitigation Measure
PS-F1: Increased Demand for Existing Energy Sources or Conflict with Adopted Policies or Standards for Energy Use	Negligible	Negligible	Negligible	Negligible	Negligible	
PS-F2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner	Negligible	Negligible	Negligible	Negligible	Negligible	PS-MM-1
PS-F3: Conflict with Emergency Response	Negligible	Negligible	Negligible	Negligible	Negligible	
PS-F4: Increased Demand for or Conflict with Utility Lines or Service Systems	Negligible	Negligible	Negligible	Negligible	Negligible	
PS-F5: Increased Solid Waste Demands	Negligible	Negligible	Negligible	Negligible	Negligible	PS-MM-1

[1.] The analysis of the two trail alternatives only considers the effects of hauling the fill to the sites. For the coastal trail, impacts of using the fill to recontour the trail are also considered.

Impact PS-F1: Increased Demand for Existing Energy Sources or Conflict with Adopted Policies or Standards for Energy Use (Short-Term, Year 0)

Impact mechanisms would be described as under Impact PS-R1.

All Fill Disposal Alternatives: Negligible. In the short term, all alternatives will have a minor increase the use of energy. Much of the energy demands associated are other aspects of the project, so the additional energy necessary to load, move and dispose of fill material will be negligible.

Impact PS-F2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner (Long-Term, Year 0)

Impact mechanisms would be described as under Impact PS-R2.

All Fill Disposal Alternatives: Negligible. Due to the need to haul fill material from the excavation to the disposal sites for all alternatives, there will be some use of gasoline to power the vehicles. However, use of fuel would be at a low

level of detection considering overall fuel supplies. Implementation of PS-MM-1 is recommended to help ensure impacts are negligible.

Impact PS-F3: Conflict with Emergency Response (Short-Term, Year 0)

All Fill Disposal Alternatives: Negligible. Hauling traffic could interfere with the use of the haul routes (Hwy 1, etc.) by emergency vehicles. However, the additional level of traffic would only consist of 50 additional vehicles per day under a worst-case scenario, and emergency responders are well versed in negotiating roadway traffic.

In addition, because the crews performing fill disposal would be located in slightly more remote locations, the potential need for emergency response at the fill disposal sites could have a minimal additional impact to the provision of public services, as emergency responder's coverage area would be slightly further afield. The emergency responders in the area are, however, prepared to deal with remote and hard-to-access locations.

Impact PS-F4: Increased Demand for or Conflict with Utility Lines or Service Systems (Short-Term, Year 0)

All Fill Alternatives: Negligible. The fill disposal sites do not contain utilities that could be adversely affected by fill disposal activities. In addition, the fill disposal activities themselves would not require utility or service systems.

Impact PS-F5: Increased Solid Waste Demands (Short-Term, Year 0)

Impact mechanisms would be described as under Impact PS-R5.

All Fill Disposal Alternatives: Negligible. Fill hauling and disposal activities would generate negligible volumes of waste material.

Mitigation Measures

Mitigation Measure PS-MM-1: Employ Sustainable Construction Practices

During the phases of site design, feature design and implementation, the NPS, its engineers and contractors shall implement the following mitigation measures:

- Minimize job site waste and reuse and recycle demolition and construction debris. Haul full loads, and minimize unnecessary vehicle trips.
- Design and engineer the bridge, roads and other structures to an appropriate and effective degree to support the uses they require and avoid over engineering.
- Design the bridge, roads and other structures for a 100-year lifespan or longer, and consider the deconstruction and reuse of the items and its materials during the design process.

- Minimize the use of resources, and avoid to the highest degree possible the choice of non-renewable, non-reusable materials.
- Stage and manage the construction job effectively, and adhere to the highest safety practices.

Mitigation Measure PS-MM-2: Maintain Utility Services

A detailed study identifying locations of utilities within the proposed project shall be conducted during the design phase of the project. For areas with the potential for adverse impacts to utility services, the NPS or its contractors shall implement the following mitigation measures:

- Utility excavation or encroachment permits shall be required from the appropriate agencies. The permits include measures to minimize utility disruption. The NPS and its contractors shall comply with permit conditions. Such conditions shall be included in construction contract specifications.
- Utility locations shall be verified through a field survey (potholing) and use of the Underground Service Alert services.
- Detailed specifications shall be prepared as part of the design plans to include procedures for excavation, support, and fill of areas around utility cables and pipelines. All affected utility services shall be notified of NPS's construction plans and schedule. Arrangements shall be made with these entities regarding protection, relocation, or temporary disconnection of services.
- Residents and businesses in the project area shall be notified of planned utility service disruption 2 to 4 days in advance, in conformance with County and state standards.
- Disconnected cables and lines shall be reconnected promptly.

Exhibit 2: Final Environmental Impact Statement

4.3.4.5 Human Health and Safety

The discussion of human health and safety refers to the potential for human exposure to hazardous substances or conditions, including fire hazards, and the protection of visitor safety. Emergency response and fire and police protection is discussed in Section 3.4.4, *Energy, Public Services, Utilities, and Service Systems* in Chapter 3.

Guiding Regulations and Policies

National Parks Service Management Policies 2006

The NPS has designated management policies related to human health and safety for park facilities as outlined below or as discussed in detail in Chapters 4, 8, and 9 of NPS Management Policies (2006a).

- *4.4.5.1 Pests*—The NPS may control native pests to manage a human health hazard when advised by the U.S. Public Health Service or to otherwise protect against significant threat to human safety.
- *4.4.5.2 Integrated Pest Management Program*—To reduce the risks to the public, park resources, and the environment from pests and pest-related management strategies, the NPS conducts an integrated pest management program. The program is followed to determine optimal management strategies for pest management.
- *4.4.5.3 Pesticide Use*—Use of a chemical, biological, or bio-engineered pesticide will be implemented by an integrated pest management specialist when other available options are either not acceptable or not feasible.
- *4.5 Fire Management*—NPS Director's Order 18 requires that each park with vegetation capable of burning prepare a plan to guide a fire management program or FMP (National Park Service 2005a). The FMP establishes a program to respond to park resource objectives and provide safety for park visitors, employees, and adjacent land uses. The plan will address both wildland and prescribed fires. Methods to suppress wildland fires will minimize impacts and ensure firefighter and public safety and protection of resources.
- *8.2.5.1 Visitor Safety*—The NPS will seek to provide a safe and healthful environment for visitors and employees by working cooperatively with other federal, tribal, state, and local agencies, organizations, and individuals. Nationally accepted codes, standards, engineering principles, and NPS guidance will be applied to protect against threats to human health and safety.
- *8.2.5.5 Public Health Program*—The NPS will work to identify public health issues and disease transmission potential in the parks and to conduct park operations in ways that reduce or eliminate these hazards.

- *9.1.6.1 Waste Management*—Any hazardous waste generated by the NPS will be disposed of separately from solid waste, in compliance with all applicable legal requirements.
- *9.1.6.2 NPS Response to Contaminants*—The NPS will make every reasonable effort to prevent or minimize the release of contaminants on NPS lands or resources. All activities pertaining to handling of contaminants will comply with federal, state, and local laws and regulations. Each park will have an oil and chemical spill response management plan.

NPS GGNRA Fire Management Plan

The 1993 GGNRA Fire Management Plan (FMP) has been recently replaced by the *Golden Gate National Recreation Area Fire Management Plan Final Environmental Impact Statement November 2005* (National Park Service 2005b), which describes fire management alternatives that are consistent with the Federal Wildland Fire Management Policy and conform to agency guidelines for fire management plans and programs. As stated in the plan's Record of Decision (National Park Service 2006d), the NPS has chosen to implement "Alternative C-Hazard Reduction and Resource Enhancement through Multiple Treatments" of the 2005 Final Environmental Impact Statement as its new fire management plan. This alternative provides for the implementation of multiple fire management strategies, including mechanical treatment and prescribed burning, to achieve the designated fire management and resource objectives. Additional actions included in the alternative are best management practices, such as:

- roadside fuel reduction;
- maintenance of defensible space around structures;
- provision of fire education materials and public outreach;
- fire effects monitoring;
- suppression of all wildland fires; and
- continued implementation of successful fire management programs (National Park Service 2006d).

The new fire management plan (i.e. Alternative C) will be used to prepare an implementation plan that outlines fire management actions over a 5-year period (National Park Service 2006d).

Marin County Local Coastal Program

Local Coastal Program policies on health and safety are identified for the community surrounding Muir Beach in Unit I of the program (Marin County 1980). Included are policies to ensure public access routes to Muir Beach protect public safety. This program also requires regulation of time, seasons, or types of use for public access, if necessary to protect sensitive habitats or nearby residences.

Marin County Code

The Marin County Code includes regulations that cover human health and safety for the County. Relevant sections of the code that relate to these topics include,

Title 17 *Health and Sanitation*, Title 10 *Parks, Open Space, and Cultural Services*, Title 15 *Traffic*, Title 16 *Fire*, Title 18 *Sewers*, Title 19 *Buildings*, and Title 23 *Natural Resource*.

Study Area

The study area for impacts on human health and safety is the project site, although off-site conditions or impacts are considered where appropriate (e.g., exposure of adjacent residents to hazardous materials).

Analysis Thresholds

The following issues, based on the NPS Management Policies and the Marin County Initial Study Checklist Form, were considered in the analysis of impacts related to human health and safety:

- Risk of accidental explosion or release of hazardous substances including, but not necessarily limited to: oil, pesticides, chemicals, or radiation.
- Creation of any health hazard or potential health hazards.
- Exposure of people to existing sources of potential health hazards.
- Increased fire hazard in areas with flammable brush, grass, or trees.

The following thresholds were used in determining the significance of impacts to human health and safety:

- **Negligible:** No effects on human health and safety would occur, or the effects would be below or at low levels of detection.
- **Minor:** The effects on human health and safety would be small but detectable, in a manner that would be noticeable to NPS staff and the public. The project would initiate or resolve a health and safety hazard, but the change in risk would be minor, and in the case of adverse impacts, could be appropriately managed without further management intervention.
- **Moderate:** The effects on human health and safety would be readily apparent. Substantial adverse or beneficial changes would be noticeable to NPS staff and the public. The project would initiate or resolve a safety or health hazard, the change in risk would be substantial, and in the case of adverse impacts, would require further management intervention to manage appropriately.
- **Major:** The effects on energy, public services, utilities, or service systems would be readily apparent. Substantial adverse or beneficial changes would be noticeable to NPS staff and the public. The impact would initiate or resolve a significant safety or health hazard, the change in risk would be severe. In the case of adverse impacts, the risk would not be able to be

appropriately managed, and/or it would preclude implementation of plans to protect human health and safety.

Methods and Assumptions

The primary focus of this discussion is on the potential for human exposure to hazardous chemicals during or after construction of the proposed project. Historically, no known contaminated sites are located in the project area (California Department of Toxic Substances Control 2005). Consequently, a Phase I Environmental Site Assessment was not conducted. The discussion of impacts to human health and safety addresses effects on visitors as well as area residents and neighboring land uses. Descriptions of relevant agency and residential operations were used to evaluate the impacts of each alternative. Risks associated with flooding are discussed in Sections 4.3.1.1, *Watershed Processes* and 4.3.4.4, *Energy, Public Services, Utilities, and Service Systems*.

Restoration Alternatives

Table 4.3.4.5-1 summarizes the potential impacts of Restoration Alternatives to public health and safety in the study area. The Restoration Alternatives are described in Chapter 2.

Table 4.3.4.5-1. Potential Human Health and Safety Impacts from Restoration Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				
Impact	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	Mitigation Measure
HS-R1: Risk of Accidental Explosion or Release of Hazardous Substances During Construction	Minor Adverse	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	WQ-MM-2: Implement Spill Prevention and Control Plan
HS-R2: Risk of Exposure to Hazardous Substances During Project Operations	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	
HS-R3: Creation of Mosquito Breeding Habitat	Negligible	Minor Beneficial	Minor Beneficial	Minor Beneficial	
HS-R4: Exposure of People to Undiscovered or Undocumented Sources of Contamination	Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/Remediation
HS-R5: Increased Fire Hazard in Areas with Flammable Brush, Grass, or Trees	Negligible	Moderate Beneficial	Moderate Beneficial	Moderate Beneficial	

Impact HS-R1: Risk of Accidental Explosion or Release of Hazardous Substances During Construction (Short-Term, Year 0)

Interim dredging activities and construction of the project would involve the use of vehicles and other construction equipment, and therefore would involve the transportation and use of hazardous materials such as fuels, lubricants and solvents. Accidental releases of small quantities of these substances could contaminate soils and degrade the quality of surface water and groundwater, resulting in a public safety hazard. A small risk of explosion would also exist in the event of an upset.

However, the NPS and its contractors would adhere to NPS Management Policy *9.1.6.2*, which addresses management of hazardous materials, and all activities pertaining to the handling of contaminants would comply with federal, state, and local regulations. In addition, the NPS and its contractors would make every reasonable effort to prevent or minimize the release of hazardous substances. Prevention of a hazardous substance release would minimize the potential for an accidental explosion. In case of an accident, the NPS and its contractors would be prepared to quickly respond to an emergency situation and protect human health and safety.

Restoration Alternative 1: Minor Adverse. Use of flammable fuels and other potentially hazardous substances would be required for the equipment used during routine maintenance dredging.

Restoration Alternatives 2, 3, 4: Minor Adverse. Use of flammable fuels and other potentially hazardous substances would be required for the equipment used during interim dredging activities and project construction. Implementation of mitigation measure WQ-MM-2, Implement Spill Prevention and Control Plan, would reduce impacts.

Impact HS-R2: Risk of Exposure to Hazardous Substances During Project Operations (Short-Term, Years 5 and 50)

Restoration Alternatives 1, 2, 3, 4: Minor Adverse. Under all alternatives, routine maintenance activities would have similar potential for hazardous materials releases as those activities conducted under current conditions. The use of pesticides in the project area for fire or invasive species management could pose a potential health hazard to park visitors or nearby residents.

Pesticide use would be administered through a NPS integrated pest management coordinator (NPS Management Policy *4.4.5.2*) and would be applied by a state-licensed pesticide applicator (NPS Management Policy *4.4.5.3*) in accordance with the pesticide manufacturer's specifications. Therefore, the potential health hazard posed by the pesticide application for these alternatives would be minor.

Impact HS-R3: Creation of Mosquito Breeding Habitat (Long-Term, Years 5 and 50)

Modifications to the existing open water and emergent wetland habitat in the project area could potentially affect the production of mosquitoes and the subsequent potential health hazard.

Restoration Alternative 1: Negligible. No actions would be taken that would change the extent of potential mosquito breeding habitat.

Restoration Alternatives 2, 3, 4: Minor Beneficial. While all action alternative involve creation of backwater or lagoon features that could provide conditions suitable for mosquito breeding, these alternatives would involve an overall reduction in mosquito breeding habitat compared to existing conditions (Table 2-3a). Therefore, these alternatives would reduce the potential for mosquito production and the resulting health hazards.

Impact HS-R4: Exposure of People to Undiscovered or Undocumented Sources of Contamination (Short-Term, Year 0)

Excavation activities associated with both interim flood reduction measures and the larger restoration have the potential to expose or mobilize hazardous substances in soils, sediments and groundwater. As described previously, the site does not contain known locations of contamination. However, there is a small potential for excavation activities to encounter unknown or unrecorded contamination sites, such as chemicals related to past agricultural land uses.

Restoration Alternative 1: Negligible. Periodic maintenance dredging would be extremely unlikely to uncover previously undiscovered or unrecorded contamination.

Restoration Alternatives 2, 3, 4: Minor Adverse. The project area is not known to have contaminated sites; however, unknown sites have a small possibility of existing, and due to the extent of excavation and site modification, minor potential for impacts exist. Implementation of mitigation measure HS-MM-1 would reduce impacts.

Impact HS-R5: Increased Fire Hazard in Areas with Flammable Brush, Grass, or Trees (Long-Term, Years 5 and 50)

A substantial amount of existing vegetation in the project area consists of annual wetland grasses, which are prone to frequent fires (3–10 year stand replacement interval) (Shlisky 2003b). Alteration of the vegetation types (i.e., fire fuel load) may alter the potential fire hazard in the project area and the potential for fires to affect human health and safety.

Restoration Alternative 1: Negligible. The type of fire fuels in the project area would not be altered therefore the potential for a fire hazard would remain unchanged from existing conditions.

Restoration Alternatives 2, 3, 4: Moderate Beneficial. Initially, construction of the project would clear the existing annual grasses and expose bare soil, thus reducing the potential fire fuel load. After construction, all the Restoration Alternatives would encourage growth of riparian vegetation and reduce the extent of annual grasses. Riparian vegetation has a longer interval of stand replacement fires (30–60 years) compared to annual grasses (Shlisky 2004, 2003a, 2003b). Consequently, the Restoration Alternatives would reduce the potential for fire hazards by encouraging growth of riparian vegetation. In addition, for

Restoration Alternatives 3 and 4, the creation of additional open water habitats would reduce the area of existing annual grasses.

Public Access Alternatives

Table 4.3.4.5-2 summarizes the potential impacts of Public Access Alternatives to public health and safety. The Public Access Alternatives are described in Chapter 2.

Table 4.3.4.5-2. Potential Human Health and Safety Impacts from Public Access Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							
Impact	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	Mitigation Measure
HS-P1: Risk of Accidental Explosion or Release of Hazardous Substances During Construction	Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	WQ-MM-2: Implement Spill Prevention and Control Plan
HS-P2: Exposure of People to Undiscovered or Undocumented Sources of Contamination	Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/ Remediation
HS-P3: Increased Fire Hazard in Areas with Flammable Brush, Grass, or Trees	Negligible	Minor Beneficial	Minor Beneficial	Negligible	Minor Beneficial	Minor Adverse	Minor Adverse	

Impact HS-P1: Risk of Accidental Explosion or Release of Hazardous Substances During Construction (Short-Term, Year 0)

Impact mechanisms would be as described under Impact HS-R1. Project operations would not involve the substantial use of hazardous substances.

Public Access Alternative A: Negligible. There would be no additional risk to human health and safety from existing conditions because no actions would be performed and no equipment would be used.

Public Access Alternatives B1 through B5 and C: Minor Adverse. Impacts would be as described for the Restoration Alternatives under Impact HS-R1. Implementation of mitigation measure WQ-MM-2, Implement Spill Prevention and Control Plan, would reduce impacts.

Impact HS-P2: Exposure of People to Undiscovered or Undocumented Sources of Contamination (Short-Term, Year 0)

Impact mechanisms would be as described under Impact HS-R4.

Public Access Alternative A: Negligible. No actions would be taken that could expose undiscovered contamination.

Public Access Alternatives B1, B2, B3, B4, B5, and C: Minor Adverse. Impacts would be as described for the Restoration Alternatives under Impact HS-R4. Implementation of mitigation measure HS-MM-1 would reduce impacts.

Impact HS-P3: Increased Fire Hazard in Areas with Flammable Brush, Grass, or Trees (Long-Term, Years 5 and 50)

As discussed in Impact HS-R5, alterations to the vegetation types in the project area could alter the potential fire frequency and the potential risk to human health by a fire hazard. However, implementation of the Public Access Alternatives would result in minor changes to the existing vegetation (Table 2-3a), fuel load, and fire hazard. Therefore, this impact focuses on the potential for fires ignited from visitor vehicles that would use the parking lot.

After construction, all alternatives would include an unpaved parking lot that is managed to encourage dense native tree cover and/or native herbaceous vegetation in areas separating parking rows. During summer months, it is possible that the vegetation in and around the parking area would die back into dry litter material that could easily burn in a fire. Hot exhaust pipes and mufflers and sparks from motor vehicles could ignite dry vegetation, particularly during warm weather conditions. Therefore, during summer months the combination of dry vegetative litter and the potential for motor vehicle-induced fires would present a small fire hazard to surrounding vegetation and residences.

Public Access Alternative A: Negligible. This alternative would not modify the vegetation in the project area or the existing parking lot. Therefore, this alternative would not increase the fire hazard potential in the project area.

Public Access Alternatives B1 and B2: Minor Beneficial. These alternatives would reduce the number of spaces for motor vehicle use. Consequently, the potential for fires caused by motor vehicles, where dry vegetation is present, would be reduced.

Public Access Alternative B3: Negligible. This alternative would allow for the same number of parking spaces compared to existing conditions. Consequently, the risk of fires caused by motor vehicles would be the same as existing conditions.

Public Access Alternative B4: Minor Beneficial. This alternative would include the same number of parking spaces compared to existing conditions. However, the parking area would be aligned parallel to Pacific Way where it would be surrounded by less vegetation. Compared to existing conditions, this alignment would slightly reduce the potential risk of fires caused by motor vehicles because the parking area would not be exposed to as much dry vegetation during the summer.

Public Access Alternative B5: Minor Adverse. This alternative would allow for an additional 25 vehicle parking spaces and would cover a larger area, compared to existing conditions. Since this alternative would allow for more vegetation to grow between the parking rows, it is likely that an increased quantity of dry dead plant matter would provide a larger fuel source for a fire. Consequently, this alternative would increase the fire hazard risk in the project area. However, routine maintenance of park facilities and implementation of the emergency response plan of Marin County, as described in Section 3.4.4, *Energy, Public Services, Utilities, and Service Systems* in Chapter 3, and implementation of the GGNRA fire management plan would adequately protect against fire hazards.

Public Access Alternative C: Minor Adverse. Compared to existing conditions, Public Access Alternative C would construct the parking area in a different location, construct a shuttle drop-off and disabled-accessible parking area, and allow for a reduced number of visitor parking spaces. Both areas would be planted with annual vegetation and surrounded by vegetation that would quickly burn during warm, dry months. Though a reduced quantity of visitor parking spaces would be allowed under this alternative, increased vehicle activity at the drop-off area would offset potential beneficial impacts on fire hazards in the project area. The fire hazard risk within the project area would potentially increase due to vehicle activities at the new parking area and the drop-off area during warm dry summer months when vegetation would have the most risk of igniting in a fire. However, routine maintenance of park facilities and implementation of the emergency response plan of Marin County, as described in Section 3.4.4, *Energy, Public Services, Utilities, and Service Systems* in Chapter 3, and implementation of the GGNRA fire management plan would adequately protect against fire hazards.

Bridge Alternatives

Table 4.3.4.5-3 summarizes the potential impacts of Bridge Alternatives to human health and safety in the study area. The Bridge Alternatives are described in Chapter 2.

Table 4.3.4.5-3. Potential Human Health and Safety Impacts from Bridge Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	Mitigation Measure
HS-B1: Risk of Accidental Explosion or Release of Hazardous Substances During Construction	Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	WQ-MM-2: Implement Spill Prevention and Control Plan
HS-B2: Exposure of People to Undiscovered or Undocumented Sources of Contamination	Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/ Remediation

Impact HS-B1: Risk of Accidental Explosion or Release of Hazardous Substances During Construction (Short-Term, Year 0)

Impact mechanisms would be as described under Impact HS-R1. Project operations would not involve the substantial use of hazardous substances.

Bridge Alternative BR0: Negligible. There would be no additional risk to human health and safety from existing conditions because no actions would be performed and no equipment would be used.

Bridge Alternative BR1, BR2, BR3 and BR4: Minor Adverse. Impacts would be as described for the Restoration Alternatives under Impact HS-R1. Implementation of mitigation measure WQ-MM-2, Implement Spill Prevention and Control Plan, would reduce impacts.

Impact HS-B2: Exposure of People to Undiscovered or Undocumented Sources of Contamination (Short-Term, Year 0)

Impact mechanisms would be as described under Impact HS-R4.

Bridge Alternative BR0: Negligible. No actions would be taken that could expose undiscovered contamination.

Bridge Alternatives BR1, BR2, BR3, and BR4: Minor Adverse. Impacts would be as described for the Restoration Alternatives under Impact HS-R4. Implementation of mitigation measure HS-MM-1 would reduce impacts.

Fill Disposal Alternatives

Table 4.3.4.5-4 summarizes the potential impacts of Fill Disposal Alternatives to human health and safety in the study area. The Fill Disposal Alternatives are described in Chapter 2.

Table 4.3.4.5-4. Potential Human Health and Safety Impacts from Fill Disposal Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail*	Mitigation Measure
HS-F1: Risk of Accidental Explosion or Release of Hazardous Substances	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	Minor Adverse / Negligible	WQ-MM-2: Implement Spill Prevention and Control Plan
HS-F2: Exposure of People to Undiscovered or Undocumented Sources of Contamination	Negligible	Negligible	Negligible	Negligible	Negligible	HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/ Remediation

* The analysis of the two trail alternatives only considers the effects of hauling the fill to the sites. For the coastal trail, impacts of using the fill to recontour the trail are also considered.

Impact HS-F1: Risk of Accidental Explosion or Release of Hazardous Substances (Short-Term, Year 0)

Transportation of fill material from the proposed project area and the disposal of fill at designated sites would involve the use of equipment with the potential to explode and/or to release hazardous substances to the surrounding area. Impact mechanisms would be as described under Impact HS-R1.

All Fill Disposal Alternatives: Minor Adverse. Use of flammable fuels and other potentially hazardous substances would be required for the equipment used to transport and/or dispose of fill material from the project. A truck accident during a fill disposal truck trip could potentially result in the release of hazardous substances. Of the Fill Disposal Alternatives, the Hamilton Alternative would have the greatest potential for an impact due to the route distance and the number of truck trips that could potentially occur between the project area and the Hamilton disposal site. However, the potential for a truck accident and potential subsequent hazardous substance spills is very low. Impacts would be as described for the Restoration Alternatives under Impact HS-R1. Implementation of

mitigation measure WQ-MM-2, Implement Spill Prevention and Control Plan, would reduce impacts.

Impact HS-F2: Exposure of People to Undiscovered or Undocumented Sources of Contamination (Short-Term, Year 0)

Impact mechanisms would be as described under Impact HS-R4.

All Fill Disposal Alternatives: Negligible. Because fill disposal activities do not involve excavation, it is extremely unlikely that the transportation and/or disposal of fill material from the project area for any of the fill disposal alternatives would result in the exposure of people to previously undiscovered or undocumented sources of contamination. Implementation of mitigation measure HS-MM-1 would also reduce potential for impacts.

Mitigation Measures

Mitigation Measure HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/Remediation

Prior to onset of construction, all construction workers shall be trained in the identification of potentially contaminated soil and/or water, including information on characteristics of potential contamination such as discolored soil, oils or sheens on water, and unusual odors. In the event that hazardous materials are encountered during construction, all construction activities in the area of the discovery will stop, and NPS shall conduct hazardous materials investigations to identify the nature and extent of contamination and evaluate potential impacts on project construction. If necessary, NPS shall implement remediation measures consistent with all applicable local, state, and federal codes and regulations. Construction will not resume until remediation is complete. If waste disposal is necessary, NPS shall ensure that all hazardous materials removed during construction are handled and disposed of by a licensed waste-disposal contractor and transported by a licensed hauler to an appropriately licensed and permitted disposal or recycling facility, in accordance with local, state and federal requirements.

4.3.4.6 Land Use, Planning, and Agricultural Resources

Guiding Regulations and Policies

NPS Management Policies

The 2006 NPS Management Policies (National Park Service 2006a) is the basic NPS-wide policy document that provides NPS management and staff with clear information on NPS policy and required or recommended actions, as well as other information to help with effective management of parks and programs. It provides policies on a wide spectrum of issues, including land protection, natural resource management, cultural resource management, wilderness preservation and management, interpretation and education, use of the parks, park facilities, and commercial visitor services.

Farmland Mapping and Monitoring Program. The Farmland Mapping and Monitoring Program (FMMP) was established more than 20 years ago as an effort to track and quantify the changes in farmland use. The FMMP prepares Important Farmland maps approximately every 2 years for most of the state's agricultural regions based on soil survey information and land inventory and monitoring criteria development by the U.S. Department of Agriculture Natural Resources Conservation Service. The FMMP categorizes various levels of farmland quality. Farmland quality refers to the ability of farmland to support various levels of crop or livestock productions. Factors that affect farmland quality include the physical and chemical characteristics of a site's soils, climate, moisture supply, topography, and the quality and availability of irrigation water.

The Important Farmland Mapping System incorporates eight mapping categories: five categories relate to farmlands, and the other three categories are associated with lands used for nonagricultural purposes. The five agricultural categories are Prime Farmland, Farmland of Statewide Importance, Unique Farmland, Farmland of Local Importance, and Grazing Land. The project is not within the boundaries of any of these categories of mapped farmlands (Farmland Mapping and Monitoring Program 2002).

California Land Conservation Act. The California Land Conservation Act of 1965—commonly referred to as the Williamson Act—is the State's primary program for the conservation of private land in agricultural and open space use. It is a voluntary, locally administered program that offers preferential property taxes on lands that have enforceable restrictions on their use via contracts between individual landowners and local governments. None of the project site is subject to a Williamson Act contract.

Regional, County, and Local Policies

GGNRA General Management Plan. The 1980 GGNRA General Management Plan (GMP) is the foundation and framework for the management and use of

GGNRA lands and articulates the desired conditions for natural and cultural resources and visitor experiences to best fulfill the park's purpose. GMPs have a planning horizon of 20 years and lay the groundwork for more detailed planning and the day-to-day decision making. The GMP considers the park as part of a larger ecological, cultural, and socioeconomic systems.

- The GGNRA GMP is in the process of being updated. However, because no updated draft has been completed, this discussion focuses on the existing, adopted plan.

Marin Countywide Plan. Land use on the portions of the project site not owned by NPS is guided by the County's General Plan, the Marin Countywide Plan (Countywide Plan), that was adopted ~~in 1994~~on November 6, 2007. At the time of circulation of the Draft EIS/EIR, the Countywide Plan had not yet been adopted. For this reason, the discussion in the Draft EIS/EIR focused on the 1994 Countywide Plan. This has been updated in this Final EIS/EIR to reflect the new plan. ~~The Countywide Plan is in the process of being updated. However, although a draft plan has been released, it has not yet been adopted. Therefore, this discussion focuses on the existing, adopted Countywide Plan.~~

The Countywide Plan takes a long-range purview for the physical development of unincorporated land in the County and identifies the proposed general distribution and intensity of existing and future land uses. The scope of the Countywide Plan reflects the theme of planning sustainable communities and to recognize the adoption of Marin County government's first strategic plan in 2001, which sought to achieve excellence in public service. The recently adopted Countywide Plan has also been enlarged to include such social equity and cultural issues as public health, environmental justice, child care, the economy, and arts and culture. The overall goals of the November 6, 2007 Countywide Plan include:

- **A Preserved and Restored Natural Environment.** Marin watersheds, natural habitats, wildlife corridors, and open space will be protected, restored, and enhanced.
- **A Sustainable Agricultural Community.** Marin's working agricultural landscapes will be protected, and the agricultural community will remain viable and successfully produce and market a variety of healthy foods and products.
- **A High-Quality Built Environment.** Marin's community character, the architectural heritage of its downtowns and residential neighborhoods, and the vibrancy of its business and commercial centers will be preserved and enhanced.
- **More-Affordable Housing.** Marin's members of the workforce, the elderly, and special needs groups will have increased opportunities to live in well-designed, socially and economically diverse affordable housing strategically located in mixed-use sites near employment or public transportation.

- **Less Traffic Congestion**. Marin community members will have access to flexible work schedules, carpools, and additional transportation choices for pedestrians, bicyclists, and transit users that reduce traffic congestion.
- **A Vibrant Economy.** Marin's targeted businesses will be clean, be prosperous, meet local residents' and regional needs, and provide equal access to meaningful employment, fair compensation, and a safe, decent workplace.
- **A Reduced Ecological Footprint.** Marin residents and businesses will increasingly use renewable energy, fuel efficient transportation choices, and green building and business practices similar to the level of Western Europe.
- **Collaboration and Partnerships.** Marin public agencies, private organizations, and regional partners will reach across jurisdictional boundaries to collaboratively plan for and meet community needs.
- **A Healthy and Safe Lifestyle.** Marin residents will have access to a proper diet, health care, and opportunities to exercise, and the community will maintain very low tobacco, alcohol, drug abuse, and crime rates.
- **A Creative, Diverse, and Just Community.** Marin will celebrate artistic expression, educational achievement, and cultural diversity, and will nurture and support services to assist the more vulnerable members of the community.
- **A Community Safe from Climate Change.** Marin will be a leader in averting and adapting to all aspects of climate change.

~~The Countywide Plan contains seven statutorily mandated elements (government Code Section 65302) and four optional elements: Environmental Quality, Community Development, Transportation, Housing, Noise, Environmental Hazards, Agriculture, Community Facilities, Parks & Recreation, and Trails. Incorporating updates from 1973 and 1982, the overall goals of the 1994 Countywide Plan are to:~~

- ~~Discourage rapid or disruptive population growth but encourage social and economic diversity within communities and in the County as a whole;~~
- ~~Achieve greater economic balance for the County, by increasing the number of jobs and the supply of housing for people who hold them;~~
- ~~Achieve high quality in the natural and built environments, through a balanced system of transportation, land use, and open space;~~
- ~~Achieve a sustainable energy future for the County by reducing total energy demand and by replacing substantial dependence on nonrenewable, imported energy resources with greater reliance on local, renewable energy resources;~~
- ~~Preserve and enhance agricultural, recreational, and open space resources and the natural environment;~~
- ~~Strive for high quality in the built environment;~~

- ~~Preserve and enhance the County's small-town community character and architectural heritage by encouraging appropriate building design and adaptive use of historical buildings;~~
- ~~Create housing and varying job opportunities for the County's economically and socially diverse population by encouraging affordable housing development and retention of clean business and industry;~~
- ~~Coordinate transportation and land use planning and provide effective public transit service that reduces dependence on automobiles, thereby reducing traffic congestion and emission of air pollutants;~~
- ~~Achieve resource conservation by reducing consumption and recycling and reusing products and resources;~~
- ~~Encourage inter-jurisdictional planning in the County to guide development that has adequate public services and maintains a high quality of life in communities and in the County as a whole; and~~
- ~~Recognize Marin's role as part of the Bay Area and encourage working relationships with neighboring counties in dealing with regional concerns about planning and capital improvement projects.~~

The General Plan outlines several resource conservation areas~~, three of which are~~ applicable to the project. They are the Stream ~~and Creekside~~ Conservation Areas (SCAs), the Wetland Conservation Areas (WCAs), the Coastal Corridor, and Coastal zone.

The SCAs are established to protect the active channel, water quality and flood control functions, and associated fish and wildlife habitat values along streams. In these areas, development must be set back to protect the stream and provide an upland buffer, which is important to protect significant resources that may be present and provides a transitional protection zone. Best management practices are required to be adhered to in all designated SCAs. Best management practices are also strongly encouraged in ephemeral streams not defined as SCAs.~~are meant to protect riparian systems, streams, and related habitat. They exist along perennial and intermittent streams, as defined by solid and dashed blue lines on USGS quad maps. Allowable uses include water supply, flood control projects, improvements for fish and wildlife habitat, grazing, agriculture, maintenance of channels for erosion control, water monitoring installations, and trails. Prohibited uses include roads, utility lines, confinement of livestock, dumping, use of motorized vehicles, and new structures.~~

WCAs require development to avoid wetland areas so that the existing wetlands and upland buffers are preserved and opportunities for enhancement are retained (areas within setbacks may contain significant resource values similar to those within wetlands and also provide a transitional protection zone). WCAs are established for jurisdictional wetlands to be retained, which includes the protected wetland and associated buffer area. Development is required to be set back a minimum distance to protect the wetland and provide an upland buffer. Larger setback standards may apply to wetlands supporting special-status species

or associated with riparian systems and baylands under tidal influence, given the importance of protecting the larger ecosystems for these habitat types as called for under Stream Conservation and Baylands Conservation policies defined in Policy BIO-4.1 and BIO-5.1, respectively. Regardless of parcel size, a site assessment is required either where incursion into a WCA is proposed or where full compliance with all WCA criteria would not be met.

The Coastal ~~Recreation~~ Corridor is reserved for federal parklands and other recreational land uses as well as preservation of existing small coastal communities. It extends from the Pacific shoreline inland, 1,000 yards or more. The policies associated with land use in this corridor are detailed in Local Coastal Plan I. The species protection section speaks to the rich variety of plants and animals in the County, as well as their increased rarity. Through the development review process, the County has established a means to protect the natural habitat.

According to the Countywide Plan, the unincorporated Muir Beach community is in West Marin Planning Area #7. Land use/zoning designations at the project site are described below under *Marin County Code*.

Marin County Watershed Management Plan. The Marin County Watershed Management Plan (Marin County 2004) provides guidance for County staff, resource managers, and policy makers and community organizations in protecting and restoring the beauty and natural function of the County's watersheds. The plan is intended to be a practical tool with specific recommendations on practices to improve and sustain a healthy, productive environment. The plan focuses on the drainages in the western portion of the County.

The Marin County Watershed Management Plan supports the policies and programs developed during the updates of the Countywide Plan and Local Coastal Program and to encourage implementation of the goals and recommendations of the community-based planning documents developed for Tomales Bay, Redwood Creek, Walker Creek, Stemple Creek, and others.

Marin County Local Coastal Program Unit I. Under the California Coastal Act of 1976, each of the 68 local governments along the California coast must prepare a local coastal plan to bring its local land use plans into conformance with the policies of the Coastal Act. Local coastal plans supersede other local land use plans and take precedence over all other local policies and zoning.

The Marin County LCP, Unit I is the County's coastal land use plan intended to guide its future development and to ensure that coastal resources are properly used and protected (Marin County 1980). The LCP was adopted by the County Board of Supervisors on August 21, 1979, and was certified by the California Coastal Commission on April 1, 1980. The LCP contains maps and policies pertaining to the use and protection of Unit I of the County's Coastal Zone. The LCP contains policies on the subjects of public access, recreation and visitor-

serving commercial facilities, federal parklands, natural resources, agriculture, mariculture, commercial fishing and recreational boating, public trust lands, shoreline structures, diking, filling, dredging, public services, and new development and land use.

The LCP mentions Muir Beach and the project site in a number of ways. The shoreline at Muir Beach includes Big Beach, Little Beach, and stretches of steep rocky shoreline. Big Beach is under the jurisdiction of the Golden Gate National Recreation Area. It details the physical characteristics, natural resource features, and management of Redwood Creek. The approval of the Pelican Inn by the Coastal Commission required the institution of a water quality monitoring program. The LCP states the need for DFG to begin empirical instream flow requirements to support anadromous fish resources. The zoning, protection, policies, and programs that the LCP outlines have been incorporated into the Countywide Plan.

Marin County Code. The County Code contains the following sections that are relevant to the planning at the project site: Title 13—Roads and Bridges, Title 22—Development Code, Title 23—Natural Resources, Title 24—Development Standards. The development code is consistent with the County General Plan.

The Southwest Marin County and Muir Beach Land Use Policy Maps (Maps 7.1 and 7.2, respectively) designate the majority of the Redwood Creek Watershed and the areas up and down the coast from the project area as Open Space (OS) and Coastal Open Space (C-OS). The area east of the project, which is owned by San Francisco Zen Center, is designated as Coastal Agriculture (C-AG1, 1 unit/31–60 acres). The Muir Beach community is designated as Coastal Single Family (C-SF5, 2–4 units/acre; C-SF3, 1 unit/1–5 acres), and the area along Pacific Way and Lagoon Drive contains both C-SF5 and C-SF3 designations. The Muir Beach community is nearly fully developed; only approximately five undeveloped parcels remain. The Pelican Inn parcel is designated as Coastal Neighborhood Commercial/Mixed Use (C-NC, 1–20 units/acre).

For the Big Lagoon project site, the zoning is C-OS and C-AG1 (Map 7.2: Muir Beach Land Use Policy Map). The Coastal Open Space zone provides for open space, outdoor recreation, and other undeveloped lands, including areas particularly suited for park and recreational purposes, access to beaches, natural drainage channels, and linkage between major recreation and open space designations. The Coastal Agriculture zone provides flexibility in lot size and building locations and thereby promotes the concentration of residential and accessory uses to maintain the maximum amount of land available for agricultural use and to maintain the visual, natural resource, and wildlife habitat values of the property and surrounding areas. The “1” of this zone refers to a unit density for residences of 1 unit per 31–60 acres.

Muir Beach Community Plan. The 1972 Muir Beach Community Plan was written by the Muir Beach Improvement Association. It describes the community’s history, planning area, concepts and objectives, community

services and systems, and land use zoning designations. It supports continued horse use and recreation on Golden Gate National Recreation Area lands, as well as protection of Redwood Creek's water quality from pollution. It acknowledges the natural values of Redwood Creek and states that its associated floodplain should be protected from development and allowed to flood in the winter.

Redwood Creek Watershed Vision for the Future. Recognizing the ecological and recreational importance of the Redwood Creek watershed, a number of local agencies recently undertook a year-long process to identify a vision for long-term management of the watershed and its resources. For a discussion of this process, please refer to Section 4.3.4.1.

Study Area

The study area for the land use, planning, and agricultural resources section represents the project boundary, which can be found on Figure 2-1.

Analysis Thresholds

The following thresholds were used in determining the consistency of project impacts to land use, planning, and agriculture:

- **Negligible:** The project would not involve any activities that would be inconsistent with land use or interfere with agricultural land uses.
- **Minor:** The project would not fully support land use policies and could be inconsistent with the policies. Conversion of agricultural lands to non-agricultural uses would be minimal and would not affect the viability of agricultural producers in the area.
- **Moderate:** The project would be inconsistent with land use policies; such inconsistencies would be localized. Conversion of agricultural lands to non-agricultural uses would affect the viability of agricultural producers in the area.
- **Major:** The project is inconsistent with land use policies, and would render wide-scale achievement of these policies impossible. Conversion of agricultural lands to non-agricultural uses would be likely to result in the elimination of agricultural production in the area.

Methods and Assumptions

The Muir Beach Community Plan (1972) has regulations and policies that have been incorporated into the Countywide Plan and therefore will not be explicitly addressed. The Countywide Plan also retains and integrates most of the LCP policies (1980), and therefore it is assumed the LCP policies are subsumed by the more comprehensive Countywide Plan. The consistency with both the 1994

Countywide Plan and the draft 2006 Countywide Plan is evaluated. While the adopted 2007 Countywide Plan has minor changes from the draft 2006 plan, these changes do not alter the conclusions of the impact analysis. The details of new or changed pertinent policies will be addressed in the staff report used for consideration of the merits of the project, and the Final EIS/EIR amendment will discuss the main relevant policies that have changed.

Other guiding regulations and policies evaluated for consistency include the CEQA Environmental Checklist Form (1999), NPS Management Policies (2006a), and the County Code (2005). The specific policies of note to the proposed project and alternatives can be found in Table 4.3.4.6-1.

Table 4.3.4.6-1. summarizes the consistency of the various alternatives with relevant land use policies. Consistency determination has been made using the following categories:

- **Consistent:** The project would be consistent with the existing policies.
- **Not consistent:** The project would conflict with the existing policies. Project modifications and priorities may be suggested to mitigate the impacts to return to a state of consistency.

The project has been found to be consistent with the following guiding regulations and policies: Marin County Watershed Management Plan, Marin County LCP Unit 1, Marin County Code, and the Muir Beach Community Plan. The preferred alternative is also consistent with the Marin Countywide Plan. Specific inconsistencies associated with other alternatives are further discussed in the impact analysis below.

Table 4.3.4.6-1. Land Use Policy Consistency Analysis

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
California Environmental Quality Act (CEQA)		
CEQA Guidelines Appendix G Environmental Checklist Form, Section II, Agriculture Resources		
(a) Would the project convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	The project is not in the boundaries of any mapped Farmland (FMMP 2002).	Consistent.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
(b) Would the project conflict with existing zoning for agricultural use, or a Williamson Act contract?	According to Map 7.2 of the Marin County Code, the project is located in an area zoned Coastal Agriculture. The project is consistent with the permitted uses of this zoning designation.	Consistent.
(c) Would the project involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use?	As identified above, the project is not in the boundaries of any mapped Farmland.	Consistent.
CEQA Guidelines Appendix G Environmental Checklist Form, Section IX, Land Use and Planning		
(a) Would the project physically divide an established community?	The boundaries of the Muir Beach community are maintained.	Consistent.
(b) Would the project conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including but not limited to the general plan, specific plan, local coastal plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	Addressed in the discussion of other plans and policies below.	See below.
(c) Would the project conflict with any applicable habitat conservation plan (HCP) or natural community conservation plan (NCCP)?	The project is not in the boundaries of any HCPs or NCCPs	Consistent.
National Park Service (NPS) Management Policies		
Park System Planning		
Policy 2.1.2 Scientific, Technical, and Scholarly Analysis	Through the process of creating a Final EIS/EIR, the project is conducting scientific, technical, and scholarly analysis.	Consistent.
2.1.3 Public Participation	Through meetings with the Big Lagoon Working Group to develop conceptual approaches and the process of preparing a Final EIS/EIR, the project is including public participation.	Consistent.
2.3.1 General Management Planning	The project is consistent with the GGNRA General Management Plan.	Consistent.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
2.3.3 Strategic Planning	GGNRA does not have a strategic plan.	Consistent.
Land Protection		
3.2 Land Protection Methods: through cooperative approaches that do not involve federal acquisition of any interest in real property.	An easement to be acquired for this project is within the GGNRA boundaries.	Consistent.
3.3 Land Protection Plans	The project is consistent with the GGNRA 1983 Land Protection Plan.	Consistent.
3.4 Cooperative Conservation	Through the process of creating a Final EIS/EIR, the project is addressing threats from external sources.	Consistent.
Agriculture and Livestock		
8.6.7 Agricultural Uses: Agricultural uses and activities are authorized in parks in accordance with the direction provided by a park's enabling legislation and general management plan. The use of pesticides and other biocontrol agents such as genetically modified or engineered organisms, should be specified in an approved resource management plan, and are subject to review and approval by the NPS integrated pest management (IPM) program manager.	All use of pesticides would be approved through GGNRA's IPM program, but none are expected to be used at this site.	Consistent.
8.6.8 Domestic and Feral Livestock: The use must be specifically authorized by a park's enabling legislation. No livestock use or activity, regardless of how authorized, will be allowed that would cause unacceptable impacts to a park's resources, values, or purposes. In particular, livestock use that depletes or degrades non- renewable resources, or whose effects cannot be satisfactorily mitigated, will not be allowed.	The project would not involve the use of livestock.	Consistent.
8.9 Consumptive Uses	The project would not involve consumptive uses.	Consistent.
Park Facilities		

Plan Policy	Consistency Analysis: Discussion	Consistency Analysis: Conclusion, Including Recommendations to Eliminate Inconsistencies
9 Facilities: Facilities will be harmonious with park resources, compatible with natural processes, aesthetically pleasing, functional, energy- and water- efficient, cost effective, universally designed, and as welcoming as possible to all segments of the population.	The bridge, parking lot and visitor amenities would be consistent with these requirements.	Consistent.
1994 Marin Countywide Plan		
Environmental Corridors		
EQ-1.3: Open space, recreational, and agricultural land uses will be emphasized in the Coast Recreation Corridor as well preservation of existing coastal communities	Restoration of Big Lagoon, improvement of public trails, and recreational access are appropriate uses in the Coastal Recreation Corridor.	Consistent.
Stream and Creekside Conservation Areas		
EQ-2.1: Value Riparian Systems. Riparian systems, streams and their associated habitat should be officially recognized and protected as essential environmental resources.	The overall goal of the project is to improve stream function and habitat value.	Consistent.
EQ-2.2: All perennial and intermittent streams defined by the appropriate U.S. Geological Survey (USGS) quad sheet should be subject to stream and creekside protection policies	The project would comply with Marin County (County), as well as federal and state, stream and creekside protection policies.	Consistent.
EQ-2.3: Stream and Creekside Conservation Areas (SCAs) should be designated along all natural water courses defined by the USGS quad sheets. The zone extends 100 feet laterally beyond the top of both banks. If necessary, the zone should extend 50 feet landward from the edge of riparian vegetation.	The project falls entirely within the SCA.	Consistent.
EQ-2.4: As long as zoning designations allow them, permitted land uses in SCAs are reconstruction and repairs of existing structures, water supply projects, flood control projects, projects to improve fish and wildlife habitat, livestock grazing and agricultural uses, water channel maintenance for erosion control, road and utility line crossings, water monitoring installations and trails.	The project would involve an aspect of many of the permitted land uses listed in this policy.	Consistent.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
EQ-2.5: Prohibited new land uses in SCAs are roads and utility lines, except at crossings, confinement of livestock, dumping or disposal of refuse, any structural improvement including residences, barns and storage buildings.	The project would not involve any of these prohibited land uses.	Consistent.
EQ-2.6: Other allowable land uses may be allowed in the SCA provided they are allowed by the underlying zoning, are on parcels that fall entirely within the zone, and it can be demonstrated that development on any other part of the parcel will have adverse effects on water quality and environmental impacts.	The project would incorporate allowed land uses.	Consistent.
EQ-2.7: All relevant agencies should take aesthetic, scenic, environmental, and recreational benefits into full consideration when computing costs of alternatives for modifications of streams.	The cost for project implementation incorporates protection of these benefits. Additionally, the project's potential impacts on these aspects are fully assessed in the corresponding section of this document.	Consistent.
EQ-2.8: The retention of natural vegetation in an SCA should be encouraged. When vegetation is removed and soil is disturbed, the area should be re-seeded or replanted with native plants. Exotic plants should be removed and replaced with native plants.	Although much of the existing native vegetation would be affected, the project would revegetate disturbed areas with native species, and invasive exotic species would be removed.	Consistent.
EQ-2.9: Disturbance of vegetation within the SCA should be minimized or avoided. Particularly important for trees and shrubs which provide shade, streambank stability, and wildlife habitat.	The project would remove some existing native vegetation within the SCA to relocate Redwood Creek into its historical channel location. Such disturbance would be minimized, and the project would revegetate stream banks with appropriate native species and restore the stream channel system to a higher functioning state.	Consistent.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
EQ-2.10: Tree and shrubs should be planted along watercourses that would naturally grow in and around the creek. When removal is unavoidable, mitigation should be 2:1 ratio. Enhancement and restoration of culverted streams is encouraged.	The project would return the current channel to its historical location, thus restoring the stream channel system to a higher functioning state. The project will provide on-site, in-kind mitigation.	Consistent.
EQ-2.11: Natural channel modification within SCAs should be done in a manner that retains and protects the vegetation forming ground cover and shade.	Although existing native vegetation in the SCA would be affected, the project would revegetate stream banks with appropriate native species and restore the stream channel system to a higher functioning state.	Consistent.
EQ-2.12: At the time of permits for site specific development, the County will evaluate impacts to riparian vegetation. The project design will incorporate measures to protect riparian vegetation, both within and beyond the SCA.	The project would improve and expand the extent of riparian vegetation.	Consistent.
EQ-2.13: SCAs are to be recognized as providing essential value to wildlife, fisheries and aquatic habitats. These areas should be maintained and enhanced, and human use of these areas should be restricted.	The project would improve wildlife habitat, while providing public access and education to encourage respect for the environment.	Consistent.
EQ-2.14: The monitoring of SCAs should work to protect vegetation, soils, water quality, and wildlife habitat.	The project includes monitoring provisions to evaluate the quality of natural conditions, and make improvements to these conditions where warranted.	Consistent.
EQ-2.15: Before the permitting of stream alterations, minimum flows necessary to protect habitats, water quality, riparian vegetation, groundwater recharge and downstream users should be determined in conjunction with the State Department of Fish and Game and the Division of Water Rights of the State Water Resources Control Board.	NPS has worked closely with all permitting agencies to ensure hydrologic and biologic conditions are protected both upstream and downstream of the site.	Consistent.
EQ-2.16: When fish or other wildlife resources may be substantially affected by development in an SCA, modifications and mitigation should be required in consultation with the State Department of Fish and Game.	NPS will comply with all regulatory requirements to ensure fish and wildlife resources are protected.	Consistent.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
EQ-2.17: Projects and stream management programs that improve fishing and enhance the abundance of sport fish are to be encouraged and supported.	The overall goal of the project is to improve stream function and fish habitat.	Consistent.
EQ-2.18: Soil disturbance within SCAs should be limited to the smallest surface area and volume of soil possible and for the shortest practical length of time.	The project would minimize the area of disturbance to only what is necessary to achieve project goals. Additionally, construction activities would be conducted during the dry season to prevent additional impacts caused by rainfall on exposed soils.	Consistent.
EQ-2.19: Surface runoff rates should not be allowed to exceed pre-development levels, or where the runoff will exacerbate an existing problem.	The project would not increase surface runoff rates compared to existing conditions, as discussed in Section 4.3.1.	Consistent.
EQ-2.20: On-site facilities for retention of sediments or contribution toward regional sediment control measures produced by development should be provided during construction and, if necessary, upon project completion.	As discussed in Section 4.3.1, measures to prevent migration of construction-related sediment would be implemented as part of the project.	Consistent.
EQ-2.21: New roads and roadfill slopes should be located outside of the SCA, except at stream crossings where special effort should be taken to stabilize soil surfaces. No spoil from road construction should be deposited within the SCA.	Land disturbance associated with relocation of the creek channel and the new bridge would be stabilized and revegetated after construction is completed. Disposal of spoils would be outside the SCA.	Consistent.
EQ-2.22: Filling, grading, excavating, obstructing flow or altering the bed or banks of the stream channel and riparian system shall be discouraged. Such activity will only be allowed after the completion of environmental review, identification of appropriate mitigation measures, and issuance of a permit by the department of Public Works.	The project would relocate the creek channel to its historical location to improve creek functioning. Construction activities would be conducted in accordance with requirements of federal, state, and local regulations. Though the project would alter the bed and banks of the stream channel, the resulting channel configuration would be improved compared to existing conditions.	Consistent

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
EQ-2.23: Development work associated with SCAs should be done during the dry season only. Disturbed surfaces should be stabilized and replanted with suitable species before the beginning of the rainy season.	Construction activities would be conducted during the dry season (April 15 to October 15).	Consistent.
EQ-2.24: Uses and development within the SCAs should enhance the appearance of the streamside environment and protect native species.	The overall goal of the project is to improve stream function and fish and wildlife habitat, including enhancement of native riparian vegetation.	Consistent.
EQ-2.25: Access to publicly owned lands within the SCA should be encouraged and improve where feasible by means of pathways, access points, and bridges. Public access will not be allowed if access will destroy or degrade the riparian habitat. Trails should be situated at an adequate distance from the stream course to afford protection of wildlife corridors. Trails may occasionally diverge to the creek and provide visual access.	Public access features, including trails, parking, and interpretive facilities, are included in the project. These would not be located in places that would impact wildlife habitat.	Consistent.
EQ-2.26: Damaged portions of the SCAs should be restored to their natural state and enhance habitat values.	The project would restore natural functioning of the creek and associated habitat.	Consistent.
EQ-2.27: Water resources should be managed in a systematic manner that is sensitive to natural capacities, ecological impacts, and equitable consideration of the many water-related needs of the County.	The project would beneficially impact water resources and would not affect water supply needs of the County.	Consistent.
EQ-2.28: High priority should be given to the protection of watersheds, aquifer-recharge areas, and natural drainage systems in any consideration of land use.	The overall goal of the project is to improve stream and watershed functions.	Consistent.
EQ-2.29: In terms of surface runoff, erosion potential, sedimentation and water quality, the effect of upstream development on downstream land uses should be examined during project review	As discussed in Section 4.3.1, the project would improve conditions related to water quality.	Consistent.
EQ-2.31: Water quality should be maintained or enhanced in order to promote the continued environmental health of natural waterway habitats.	As discussed in Section 4.3.1, the project would improve conditions related to water quality.	Consistent.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
EQ-2.32: The use of streams and surrounding lands for educational purposes should be encouraged.	The project includes an educational component through interpretive facilities.	Consistent.
EQ-2.33: Streams in project areas should include vegetated buffer areas of native plants to protect habitat for wildlife, preserve and focus views and assure public safety. Vegetated buffer areas should be utilized except where safety issues or specific environmental concerns need to be addressed.	Appropriate setbacks and vegetated buffers have been incorporated into the project. Public access areas have been designed according to Americans with Disabilities Act (ADA) approved specifications.	Consistent.
EQ-2.34: To the greatest extent possible, land division in SCAs should be reviewed to allow for management of the creeks by one property owner.	There would be no land divisions under the project.	Consistent.
EQ-2.35: Any agency or individual responsible for management of SCAs should undertake the responsibility for implementation of all SCA policies.	The County and NPS would ensure all SCA policies are implemented.	Consistent.
EQ-2.36: The ordinance for floodplain management, in compliance with the Federal Flood Control Insurance Program, should continue to be implemented.	The project would comply with the floodplain management ordinance and Federal Emergency Management Agency regulations.	Consistent.
EQ-2.38: Flood control measures should retain natural features and conditions as much as possible. Compatible uses such as agriculture, wildlife habitat, and recreation should be promoted.	The project would restore natural floodplain functioning while promoting multiple land uses.	Consistent.
EQ-2.40: Filling and other physical alteration in floodways, floodplains, or ponding areas should be limited to the minimum necessary as determined in development permits issued by the County.	The project would minimize disturbance to only those areas necessary to achieve project goals.	Consistent.
EQ-2.41: Conservation of coastal resources shall be maintained following detailed policies in Local Coastal Plan I.	The project would conserve and enhance coastal resources; portions of the project within the jurisdiction of the Local Coastal Plan would follow its policies.	Consistent.
Species Protection		
EQ-2.87: Environmental review shall consider the impact of the proposed project on species and habitat diversity. Mitigation measures should be proposed.	The potential impacts to biological resources have been reviewed and are discussed in Section 4.3.2.	Consistent.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
EQ-2.87a: Project permits shall include mitigation measures to ensure the continued health and survival of the habitat, plants, and wildlife.	The County and NPS would comply with all permit conditions required by federal, state, and local agencies to implement the project.	Consistent.
EQ-2.87b: Permits shall include conditions and/or mitigation measures to ensure wildlife corridors for movement and dispersal are not destroyed or altered in such a way as to destroy or significantly diminish the diversity of species using the site.	The project would maintain or improve wildlife corridors.	Consistent.
EQ-2.87c: Development applications shall be conditioned or modified to ensure that edge habitats are not destroyed or altered in such a way as to destroy or significantly diminish the diversity of species using the site.	The project would include a variety of ecotonal habitats.	Consistent.
EQ-2.87d: When an environmental assessment indicates the need, the County should encourage plans to regenerate plant species.	The project would revegetate disturbed areas with native plant species and remove invasive and exotic species.	Consistent.
EQ-2.87e: When development is proposed on lands adjacent to State or Federal parklands, the County shall require removal of all invasive exotic vegetation prior to development.	The project would remove invasive exotic vegetation from the project site.	Consistent.
EQ-2.88: To ensure the continued health and survival of species and areas, development shall be restricted or modified in areas that contain special status species and migratory species of the Pacific Flyway and/or significant natural areas, wetlands, riparian habitats, and freshwater habitats.	The project would protect and enhance habitat for special-status and migratory species.	Consistent.
EQ-2.88a: Development permits shall include conditions of mitigation measures to ensure the continued health and survival of special status species, migratory species of the Pacific Flyway and Significant Natural Areas, wetlands, riparian habitats, and freshwater habitats. Development projects shall be modified to either avoid impact to sensitive communities or mitigate impacts by providing on- or off-site replacement.	The project would protect and enhance habitat for special-status and migratory species. Implementation of mitigation measures would prevent significant long-term impacts to sensitive communities.	Consistent.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
EQ-2.88b: Environmental assessment needs to be conducted on sites identified by the Department of Fish and Game as Significant Natural Areas.	Extensive environmental assessment of the site has been conducted.	Consistent.
EQ-2.88c: The County Community Development Agency should establish and maintain a Species Protection Resource Center in order to accurately assess potential impacts of proposed development on species and habitat diversity.	This policy is not applicable to the project.	Consistent.
Open Space and Recreation		
EQ-4.1: Adequate parks, recreation facilities, and open space shall be provided.	The project would be a public park that provides recreation facilities for visitors and open space for wildlife.	Consistent.
EQ-4.2: A countywide trail system shall be provided for recreational purposes and to give the public alternative transportation routes.	The project would support and enhance the use of trails in the County.	Consistent.
EQ-4.3: When feasible, publicly owned park and open space areas should be made available to and useable by all segments of society.	The project would be on publicly owned lands and open to use for all visitors.	Consistent.
EQ-4.4: Water edges, tidal areas, marshes stream and creeks shall be permanently preserved.	The overall goal of the project is to protect and enhance wetland, tidal lagoon, creek, and associated wildlife habitat.	Consistent.
EQ-4.7: Identification of the open space preservation areas, such as Golden Gate National Recreation Area.	The project would be within GGNRA.	Consistent.
EQ-4.7a: maintain in its natural state to the greatest extent possible the open space area, which includes Muir Beach	The project would protect and enhance open space area, including Muir Beach.	Consistent.
EQ-4.7b: Agricultural zoning and contracts should be used to preserve and maintain portions of the open space corridor in their present dairying and ranching uses.	The project would be consistent with the existing Coastal Agricultural zoning designation. The project is consistent with the General Plan in preserving natural resources (wetland and wildlife habitat) while allowing for continued agricultural production on adjacent sites.	Consistent

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Community Development		
CD-1.3: Open space, recreational, and agricultural land uses will be emphasized in the Coastal Recreation Corridor along with the preservation of existing coastal communities.	The project would support open space and recreational land uses and would not preclude adjacent agricultural land uses.	Consistent.
CD-2.7: Development should be discouraged in areas which have high natural resource value.	The project would restore and enhance existing natural resources.	Consistent.
CD-2.10: Buildings and areas with special recognized historic, architectural or aesthetic value should be preserved.	The project would implement mitigation measures prescribed in Section 4.3.3 *Cultural Resources* and Section 4.3.4.3 *Aesthetics* to ensure these resources are preserved.	Consistent.
CD-6.9: Marin County will coordinate with the National Park Service during review of development applications for property adjacent to or within park boundaries.	The County and NPS have coordinated review of the project and potential permitting requirements.	Consistent.
CD-8.8: When not covered by the Local Coastal Program, agricultural land use categories shall be established to preserve and protect agricultural uses.	No activities would be conducted in areas with existing agriculture that are not covered by the Local Coastal Program.	Consistent.
CD-8.9: Land shall be designated for agriculture and conservation where it has resource value for both agricultural production and for wetland and wildlife habitat.	The project would be consistent with the existing Coastal Agricultural zoning designation. The project is consistent with the General Plan in preserving natural resources (wetland and wildlife habitat) while allowing for continued agricultural production on adjacent sites.	Consistent
CD-8.10: For areas within the Coastal Zone, the lands shall be subject to the additional provisions of Marin County's Local Coastal Program I.	The County and NPS will comply with policies of the Local Coastal Program I.	Consistent
CD-15.1: The County shall designate and maintain lands for agriculture at low densities in the Coastal Recreation Corridor.	The project would be consistent with the existing Coastal Agricultural zoning designation. The project maintains low densities.	Consistent.

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CD-15.2: The Local Coastal Program I shall govern land use in the Coastal Zone and community plans shall be subject to their policies.	The County and NPS will comply with policies of the Local Coastal Program I.	Consistent.
CD-15.4: A community plan for each community shall be adopted to maintain its character, heritage and identity of villages.	The project is within the boundaries of the Muir Beach Community Plan	Consistent.
CD-15.6: Large-scale development or new urban service provision that would rapidly or drastically change the character of the village should be avoided.	The project does not involve large-scale development or new urban service provision.	Consistent.
CD-15.9: No large tourist facilities should be allowed in the villages, but small tourist-oriented businesses may be permitted.	The project would not expand tourist facilities.	Consistent.
CD-15.11: The Muir Beach Community Plan shall govern land use in Muir Beach. Provided by Land Use Policy Map 7.2, the community should maintain its rural residential environment with surrounding lands designated for agricultural use.	The project would meet the goals of the plan and enhance the residential environment of the Muir Beach community.	Consistent.
Noise		
N-2.4: During all phases of construction, measures should be taken to minimize the exposure of neighboring properties to excessive noise levels from construction-related activity.	Measures to reduce construction-related noise during project construction are provided in Section 4.3.4.7, *Noise*.	Consistent.
Environmental Hazard		
EH-1.1: The County should advise citizens on the availability of Countywide and local area environmental hazards studies, sources of hazard information, and public services.	Section 4.3.4.5, *Human Health and Safety* provides this information as related to the project.	Consistent.
EH-2.1: Structures necessary for the protection of public safety and / or the provision of emergency services should not be located in areas subject to inundation, subsidence, slope failure, or ground failure in a seismic event. An exception to this policy may be granted if the only alternative location would be so distant as to jeopardize the safety of the community, given that adequate precautions are taken to protect the facility.	Potential impacts to public safety are assessed and discussed in Section 4.3.4.5, *Human Health and Safety*. The new bridge on Pacific Way would be designed and constructed to withstand such hazards and cannot be feasibly located elsewhere.	Consistent.

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EH-3.1: New development shall be sited in a manner that avoids or minimizes the potential of hazards from earthquake, erosion, landslides, floods and fire.	As discussed in Section 4.3.1, *Physical Resources*, implementation of the project would reduce the potential for hazards.	Consistent.
EH-7.3: Structural design of foundations and utilities shall recognize the potential for differential settlement and subsidence.	Construction of the project would be conducted and designed according to federal and state standards for safety.	Consistent.
EH-7.4: The department of public works should continue to determine the adequacy of engineered fills prior to the construction of structures.	NPS would comply with County requirements for project components requiring engineered fill.	Consistent.
EH-8.3: Provided these uses can tolerate occasional flooding, the County should continue to promote the multiple use of areas set aside for flood retention ponding purposes such as agriculture, open space, education, ecology.	The project incorporates multiple uses in its design.	Consistent.
EH-8.4: The County should encourage regulatory methods of flood control, rather than construction-related methods of flood control.	The project would improve flooding conditions according to federal, state, and local standards.	Consistent.
EH-8.5: Minimize flooding hazards by the use of floodplain zoning overlays in flood areas.	The project would improve flooding conditions by restoring the natural stream channel and functioning.	Consistent.
EH-8.6: The County should ensure capacity is maintained in stream channels.	The project would improve flood conveyance capacity in the Redwood Creek channel.	Consistent.
EH-8.7: The County should prevent the construction of flood barriers that will unnaturally divert flood waters or increase flood hazard in other areas.	The project would remove barriers to flood conveyance by restoring the creek's natural channel and constructing a new bridge crossing.	Consistent.
EH-10.1: The County will consider the potential for a sea level rise when processing development applications that may be affected by such a rise.	The potential impacts of sea level rise have been considered as part of project design.	Consistent.

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EH-11.4: Marin County and local fire protection agencies should work in concert with the Open Space District, Division of Forestry, and National Park Service to encourage and promote the maintenance of existing fuel breaks and emergency access routes for fire suppression.	The County and NPS would continue to cooperate with other federal, state, and local agencies to manage potential fire hazards at the project site.	Consistent.
EH-11.6: The County should plan for the systematic and environmentally sound reduction of hazardous vegetation.	The County and NPS would continue to cooperate with other federal, state, and local agencies to manage potential fire hazards at the project site.	Consistent.
Agriculture		
EQ-2.59: Agricultural activities should minimize and avoid removal of natural vegetation.	The project would not involve agricultural activities.	Consistent.
A-1.1: Agricultural lands shall be preserved by maintaining agricultural parcels in sizes large enough to sustain agricultural production, avoiding conversion of agricultural land to non-agricultural uses, discouraging uses which are not compatible with long term agricultural productivity, and encouraging programs that assist agricultural operators and owners in maintaining the agricultural productivity of their land and marketing their products.	Agricultural lands and uses will be preserved consistent with County General Plan priorities of protecting the County's natural resources.	Consistent
A-1.3: The County shall discourage subdivision of agricultural lands.	The project would not involve subdivision of agricultural lands.	Consistent
A-1.5: The County shall encourage the acquisition and/or dedication of perpetual agricultural conservation easements.	The project would not discourage acquisition and/or dedication of such easements.	Consistent.
A-1.9: The County shall support the continued agricultural operations and agricultural land uses within the “pastoral zones” of the Golden Gate National Recreation Area.	The project would maintain agriculture consistent with County General Plan priorities of protecting the County's natural resources.	Consistent.
A-1.10: Non-agricultural land uses on agricultural lands should be compatible with agricultural land uses and with the rural character.	The project would not be incompatible with other agricultural land uses or rural character in the area.	Consistent.
Community Facilities		

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CF-2.1: The County will maintain the rural character of lands located in the Coastal Recreation Corridor and maintain consistency with other relevant Planning Elements.	The project would be consistent with the rural character of the Coastal Recreation Corridor.	Consistent.
CF-3.4: Utilities and treatment facilities in local plans should be improved, if necessary, before service is extended to new areas.	The project would not require service from local utilities.	Consistent.
CF-3.5: Local public agencies should improve the efficiency of operations through using available technical assistance programs in construction, operations and maintenance, and purchasing.	Construction of the project would be streamlined to the extent feasible.	Consistent.
CF-4.5: Areas that are not suitable for development because of natural hazards or resource value should not be included in an urban service area.	The project would not be located in an urban service area.	Consistent.
CF-5.1: Public and private services should be designed to accommodate the level of development planned by the cities and the County.	The project would not construct or require services.	Consistent.
CF-5.3: Public facilities should be designated to minimize both short-term and long-term construction, operation, and maintenance costs.	Construction of public facilities associated with the project would be minimized to the extent feasible. Operation and maintenance costs would be similar to existing conditions.	Consistent.
CF-5.4: Wastewater should be recycled for reclamation and reuse when feasible.	The project would not involve generation of wastewater.	Consistent.
CF-5.6: Community facilities should be designed or rehabilitated to remove barriers to disabled persons.	The project would be ADA compliant and provide access for disabled persons, as discussed in Section 4.3.4.4, *Energy, Public Services, Utilities, and Service Systems*.	Consistent.
CF-5.7: energy efficiency and renewable energy use should be included as criteria for approving and designing capital improvement projects.	Operation of the project would not require use of energy.	Consistent.

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CF-5.8: The County community development agency and office of waste management will continue to implement the Marin County Source Reduction and Recycling Element	The project would comply with the Source Reduction and Recycling Element by providing waste and recycling containers for public use.	Consistent.
Parks and Recreation System		
PR-1.1: The County will plan its park and recreation facilities as a part of a comprehensive system of local, district, regional, State and National parks and open space providing for active recreation, passive enjoyment and the protection of natural resources.	The project would enhance an existing National Park and continue to provide for active recreation, passive enjoyment, and the protection of natural resources.	Consistent.
PR-2.2: The County will continue efforts to provide facilities that will supplement and augment facilities offered by other park and recreation jurisdictions.	The County and NPS have been and would continue to coordinate in the development of the project.	Consistent.
PR-2.3: The County will attempt to replace park and recreation facilities that are closed or that become unavailable for other reasons	The project would provide additional recreational opportunities through extending trails and improving public access to the park.	Consistent.
PR-2.4: The County will coordinate efforts to replace closed popular countywide recreational facilities that are operated by other local jurisdictions or by the private sector.	The project would reduce the frequency of park closures through improvements to public access points, particularly during flooding events.	Consistent.
PR-2.5: The County will plan for park and recreation capital facilities and pursue a variety of available funding sources	The project is an existing park and recreational facility; the County would pursue a variety of funding options for the bridge replacement.	Consistent.
PR-3.2: The County will assist unincorporated communities with the provision of recreation programs in these communities.	The project would enhance recreational opportunities for the Muir Beach community.	Consistent.
PR-3.4: The County will provide assistance with special programs for special populations whenever possible.	The project would enhance equal recreational opportunities for all.	Consistent.
PR-3.5: The County will serve as a resource and facilitator for all agencies providing park and recreation facilities and services in the County.	The County and NPS are coordinating during project development.	Consistent.

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Trails		
TR-1.2: Where public trails begin or continue onto private land subject to closure, the County should attempt to secure permanent access across private lands.	The project would enhance permanent connections and use of existing trails on NPS lands.	Consistent.
TR-1.3: The County should acquire a network of trails that will serve a specific public purpose of access to or between public lands.	The project would support the existing network of public trails.	Consistent.
TR-1.4: A public entity reviewing a development proposed on lands traversed by important trail connections may require the dedication of trail easements and / or the improvement of trails consistent with the adopted Trail Element.	Improvements to existing trails are incorporated as part of the project.	Consistent.
TR-2.1: The County shall coordinate planning for trails including trails acquisition, development and maintenance.	The County and NPS are coordinating during project development.	Consistent.
TR-3.1: Locate trails away from sensitive habitat such as wetlands and areas where endangered species may be adversely affected.	The project would improve existing trails to ensure protection of sensitive habitats.	Consistent.
TR-3.2: Design trails in consideration of adjacent property owners and their lands.	Trails associated with the project would not conflict with adjacent property owners or their lands.	Consistent.
TR-3.3: Trail design and designation should consider historic users and ensure user safety for a diverse range of trail users.	The project accounts for the possibility that the Coastal Trail belongs in the National Register of Historic Places. The project would address the design of the trail systems to ensure the safety of its users.	Consistent.
TR-3.4: Whenever feasible, design and develop trails with opportunities to meet the accessibility needs of all segments of the population.	The project would address the design of the trail system to be ADA compliant to the greatest degree possible.	Consistent.

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TR-3.5: Design trails with multiple ingress and egress points with appropriate signage to minimize the need for parking at trailheads. Parking needs should be addressed as well.	Trails of the project would have multiple access points from the parking lot, Green Gulch, and Hwy 1, and would have the appropriate NPS signage. Some of the Public Access Alternatives would reduce the number of parking spaces.	Public Access Alternatives A, B3, B4 and B5: Consistent. Public Access Alternatives B1 and B2: Not Consistent.
TR-4.1: Trails should be maintained by property owners or entities accepting dedicated trails or easements unless other arrangements have been contractually agreed upon.	The trails within the project would be maintained by NPS.	Consistent.
2006 Draft Marin Countywide Plan		
Biological Resource Policies		
Bio-1.1: Protect Wetlands, Essential Habitat for Special-Status Species, Sensitive Natural Communities, and Important Habitat Corridors.	The project would improve wetlands, habitat, and corridors for special-status species.	Consistent.
Bio-1.2: Acquire Habitat. Acquire areas containing sensitive habitat for use as permanent open space and linking to permanently protected open space. Encourage and support public and private partnerships formed to acquire and manage important natural habitat areas such as coastal shorelines.	The project includes the integration of the trail network, coordination between NPS and private interests to managed ecologically significant Muir Beach area, and maintenance and improvements to permanent open space.	Consistent.
Bio-1.5: Promote Use of Native Plant Species. Encourage use of native or compatible native plant species indigenous to the site vicinity as part of project landscaping to improve wildlife habitat values.	The project includes replanting with native species.	Consistent.
Bio-1.6 / 1.7: Remove and Control the Spread of Invasive Exotics. Work to remove invasive plants listed in the State's Noxious Weed List, California Exotic Pest Plant Council's List of Ecological Pest Plants and other priority species identified by the Agricultural Commissioner and California Department of Agriculture.	The project would remove and control invasive exotics.	Consistent.
Bio-2.1: Include Resource Preservation in Environmental Review.	This Final EIS/EIR considers resource protection.	Consistent.

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Bio-2.2: Require Environmental Assessments.	This Final EIS/EIR fulfills this requirement.	Consistent.
Bio-2.3: Limit Development Impacts. Restrict or modify proposed development in areas that contain essential habitat for special-status species, sensitive natural communities, wetlands, coastal and riparian habitat, as necessary to ensure the continued health and survival of these species and sensitive areas.	The overall project would improve the identified habitats. The bridge and public access facilities in particular would be designed to avoid or minimize effects on wetlands, coastal and riparian habitat, and sensitive natural communities to the highest degree possible.	Consistent.
Bio-2.4: Preserve Ecotones. Condition or modify development permits to ensure that natural transitions between habitat types are preserved and enhanced	The project and its alternatives seek to preserve and enlarge the ecotones of the riparian habitat, lagoon and marshlands.	Consistent.
Bio-2.5: Protect Wildlife Corridors. Condition development permits in accordance with applicable mitigation measures to ensure that important corridors for wildlife movement and dispersal are protected.	The project and its alternatives seek to protect and improve wildlife corridors for special-status salmonid species. With respect to terrestrial wildlife, Bridge Alternatives BR3 and BR4 would provide a wider area through which wildlife can move along the valley floor, riparian corridor, and stream channel.	Consistent.
Bio-2.6: Identify Opportunities for Safe Wildlife Movement. Ensure that existing stream channels and riparian corridors continue to provide wildlife movement under roadway bridges while maintaining the existing channel bottom	The project relocates the primary channel of Redwood Creek and improves the alignment to the bridge. All **Bridge Alternatives** would provide better opportunities for aquatic and terrestrial wildlife movement. Bridge Alternatives BR3 and BR4 would provide a wider area through which wildlife can move along the valley floor, riparian corridor, and stream channel.	Consistent.
Bio-2.7: Prohibit Development in Sensitive Coastal Habitat. Continue to protect coastal dunes from development in accordance with coastal resource management standards in the development code.	Overall, the project **Restoration Alternatives** would improve coastal dune habitat and avoid development in sensitive areas.	Consistent.

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Bio-2.8: Coordinate with Trustee Agencies.	Inherent to the completion of an EIS/EIR is coordination with Trustee Agencies.	Consistent.
Bio-2.9: Promote Early Consultation with Other Agencies. Require applicants to consult with all agencies with review authority for projects in areas that support wetlands and special status species.	The County and NPS are in communication with other agencies and have a good understanding of their requirements.	Consistent.
Bio-3.1: Protect Wetlands. Require development to avoid wetland areas so existing habitat and buffers are preserved and opportunities for enhancement are retained. For Coastal Recreation Corridors, maintain a minimum 100 foot buffer on large (>5 acres) properties.	Although this project and its alternatives do not avoid wetlands, the post-project condition would improve functioning wetland system and would meet the no-net loss standard.	Consistent.
Bio-3.2: Require thorough Mitigation. Where complete avoidance of wetlands is not possible, require provision of replacement habitat on-site through restoration and/or habitat creation at a 2:1 ratio, provided no net loss of wetland acreage, function, and habitat values.	Because this project would result in improved wetland function, this project would provide on-site, in-kind mitigation, as applicable.	Consistent.
Bio-4.1: Restrict Land Use in Stream Conservation Areas (SCAs). Limit land uses in SCAs to those that create minimal disturbance or alternation to water, soils, vegetation and wildlife that maintain or improve stream function or habitat values.	The overall goal of the project is to improve stream function and habitat value. The land use for the project would be limited to the periphery of the valley, with every attempt to maintain appropriate setbacks.	Consistent.
Bio-4.2: Require Compliance with SCA Regulations. Implement established buffers and criteria for protection of SCAs through permit review process and adoption of new ordinances. Exceptions to full compliance may be allowed if the parcel falls entirely within the SCA.	Although the project will comply with the SCA regulations, it is also allowed exemptions because it falls entirely within the SCA.	Consistent.

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Bio-4.4: Promote Natural Stream Channel Function. Retain and, where possible, restore the hydraulic capacity and natural functions of stream channels in SCAs.	The restoration and **Bridge Alternatives** would work to remove impediments to fish passage, improve spawning habitat, return the current channel to its historical location, allow for channel migration and avulsion, improve low and bankfull flows, and restore the stream channel system to a higher functioning state.	Consistent.
Bio-4.5: Restore and Stabilize Stream Channels. Pursue stream restoration and appropriate channel redesign where sufficient right-of-way exists.	The restoration and **Bridge Alternatives** would work to return the current channel to its historical location, allow for channel migration and avulsion, improve low and bankfull flows, revegetate stream banks with appropriate native species, and restore the stream channel system to a higher functioning state.	Consistent.
Bio-4.6: Control Exotic Vegetation. Remove and replace invasive exotic plants with native plants as part of stream restoration projects and as a condition of site-specific development approval in an SCA.	The project would remove and control invasive exotics and replace them with native plant species.	Consistent.
Bio-4.7: Protect Riparian Vegetation. Retain riparian vegetation for stabilization of streambanks and floodplains, moderating water temperatures, trapping and filtering sediments and other water pollutants, providing wildlife habitat, and aesthetic reasons.	Although much of the existing native vegetation would be affected, the **Restoration Alternatives** would revegetate stream banks with appropriate native species and restore the stream channel system to a higher functioning state.	Consistent.
Bio-4.8: Reclaim Damaged Portions of SCAs. Restore damaged portions of SCAs to their natural state wherever possible.	The removal of the levee road, abandoned utility lines, and concrete lining of Green Gulch Creek and return of the channel to its historical location reclaim damaged portions of the SCA.	Consistent.
Bio-4.10: Promote Interagency Cooperation.	The project planning process has involved extensive interagency coordination.	Consistent.

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Bio-4.11: Promote Riparian Protection. Support agencies, organizations, and programs in Marin County that protect, enhance, and restore riparian areas.	This project seeks to promote riparian protection.	Consistent.
Bio-4.12: Support Riparian Education Efforts. Educate the public and County staff about the values, functions, and importance of riparian areas.	The project has had an extensive outreach process that has educational benefits. In addition, the project includes an educational component through interpretive facilities.	Consistent.
Bio-4.13: Provide Appropriate Access in SCAs. Ensure that public access to publicly owned land within SCAs respects the environment, and prohibit access if it will degrade or destroy riparian habitat.	The Public Access Alternatives all provide ADA-approved access, and would be designed with respect for the environment.	Consistent.
Bio-4.14: Reduce Road Impacts in SCAs. Locate new roads and roadfill slopes outside of SCAs, except at stream crossings. Require spoil from road construction to be deposited outside the SCA, and take special care to stabilize soil surfaces.	The project and its Public Access Alternatives would replace the existing road and remove an old levee road from the SCA. All fill alternatives are outside of the SCA.	Consistent.
Bio-4.15: Reduce Wet Weather Impacts. Ensure that development work adjacent to and potentially affecting SCAs is not done during the wet weather or when water is flowing through streams, except for emergency repairs.	The project's construction would be during the dry season (April 15 to October 15).	Consistent.
Healthy Watershed Policies		
WR-Policies: Address watershed management priorities such as groundwater recharge, erosion, sedimentation, runoff, infiltration, nutrient loading, water quality, etc.	The Final EIS/EIR addresses groundwater recharge, runoff, and water quality issues.	Consistent.
Open Space Policies		
OS-1.1: Enhance Open Space Stewardship. Continue to identify means of restoring, preserving and protecting open space for environmental health, sustainability, and public use and enjoyment.	The project addresses and incorporates the stewardship of open space.	Consistent.

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OS-2.2: Preserve Open Space for Future Generations. Ensure that protected open space remains open in perpetuity for the benefit of residents, visitors, citizens, wildlife and the environment.	The project would not change the status of protection for open space.	Consistent.
OS-3.3: Identify Appropriate Use in the Coastal Recreation Corridor. Determine appropriate levels of protection and recreation use for coastal lands.	The restoration of Big Lagoon, improvement of trails, and recreational access are appropriate uses in the Coastal Recreation Corridor.	Consistent.
Trails System Policies		
TRL-1.1: Sustain the Countywide Trail System. Continue to provide a countywide trail system that offers recreational opportunities and alternate public transportation routes that may lessen reliance on automobile use and new road construction.	The project and its alternatives would sustain and improve the local application of the countywide trail system. The project is consistent with existing alternate public transportation routes.	Consistent.
TRL-1.2: Add to the Public Trail Network. Through various means seek to establish additional trails and trail segments that will serve the specific public purposes of providing access to or between public lands and enhancing public trail use opportunities.	The project would improve trail connectivity through such actions as construction of a pedestrian path from Hwy 1 to the beach, which would also link to a new alignment of the Dias Ridge trail.	Consistent.
TRL-2.1: Preserve the Environment. In locating and designing trails, take into account environmental preservation, including impacts on individual watersheds.	The project would address the design of the trail systems to avoid watershed impacts, erosion, sedimentation, and hydrologic alterations.	Consistent.
TRL-2.3: Ensure User Safety. Plan trails to protect the safety of anticipated users.	The trails in the project would be designed to ensure the safety of its users and would improve safety by providing a separate trail to Pacific Way.	Consistent.
TRL-2.4: Consider Historic Use. In both trail design and designation, take into account the uses that have occurred on trails or underlying rights-of-way historically.	The proposed project accounts for the possibility that the Coastal Trail belongs in the National Register of Historic Places.	Consistent.
TRL-2.5: Provide Access for Persons with Disabilities. Whenever feasible, design and develop trails with opportunities to meet the accessibility needs of all segments of the population.	The project would address the design of the trail system to be ADA compliant to the greatest degree possible.	Consistent.

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TRL-2.6: Provide Multiple Access Points. Design trails with multiple access points and appropriate signage to minimize the need for parking at trailheads.	Trails of the project would have multiple access points from the parking lot, Green Gulch Farm, and Hwy 1 and would have the appropriate NPS signage.	Consistent.
Agricultural Resource Policies		
AG-1.2: Encourage Contractual Protection. Facilitate agricultural conservation easements, land conservation and farmland security zone contracts, and transfer of development rights.	The project will entail agreements for land conservation, and existing uses will not be altered..	Consistent.
AG-1.3: Preserve Agricultural Zoning. Maintain very low-density agricultural zoning in the Coastal Recreation Corridors to support land-extensive agricultural production and discourage conversion to non-agricultural uses.	The project is consistent with existing agricultural zoning designations	Consistent.
AG-1.4: Limit Non-Agricultural Zoning. Apply non-agricultural zoning only in areas where conflicts with agricultural uses will be minimized, and ensure that development standards preserve and enhance nearby agricultural uses.	The project would not be located in an area of non-agricultural zoning.	Consistent.
AG-1.5: Discourage Subdivision of Agricultural Lands. Allow subdivision of agricultural land only upon demonstration that long-term agricultural production on a specific parcel will be enhanced through the proposed subdivision.	The project does not involve subdivision of agricultural lands.	Consistent.
AG-1.6: Limit Non-Agricultural Development. Limit non-agricultural development in the Agricultural Production Zone to allowed residential and accessory uses incidental to and compatible with agricultural production.	The project does not include development of agricultural lands. Resource restoration is consistent with the plan's agricultural objectives	Consistent.
AG-1.7: Limit Ancillary Non-Agricultural Land Uses. Require non-agricultural land uses on agricultural lands to be ancillary, subordinate to, and compatible with, agricultural land uses, agricultural production, and the rural character of the area, and to enhance the economic viability of agricultural operations.	The project maintains agriculture while addressing the General Plan's first priority of preserving natural resources. The project does not include ancillary development..	Consistent.

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AG-1.8: Maintain the Agricultural Land Base. Encourage private and public owners of lands that have traditionally been used for agriculture to keep land in agricultural use by continuing existing agricultural uses and developing compatible new agricultural uses.	The project would continue agricultural uses of agricultural designated lands. Resource restoration is compatible with the plan's agricultural objectives.	Consistent.
AG-1.10: Protect Productive Agricultural Soils. Discourage of prohibit buildings, impermeable surfaces, or other non-agricultural uses on soils classified by the Natural Resources Conservation Service as Prime Farmland or Farmland of Statewide Importance.	The project site is not classified as a Prime Farmland or Farmland of Statewide Importance.	Consistent.
AG-1.12: Expand Water Supplies. Support the development of water supplies for row crop production provided it does not degrade aquatic resources, especially in areas on soils classified as Prime Farmland or Farmland of Statewide Importance.	The project is not inconsistent with development of water supplies for row crops.	Consistent.
AG-2.1: Promote Organic Certification. Support Marin Organic Certified Agriculture (MOCA) to perform local organic farm certification to comply with National Organic Program (NOP) standards.	The Green Gulch Farm is a certified organic farm whose operations will not be affected by the project.	Consistent.
AG-2.2: Promote Small-Scale Diversification. Diversify agricultural uses and products on a small percentage of agricultural lands to complement existing traditional uses, help ensure the continued economic viability of the county agricultural industry, and provide increased food security.	The project does not prohibit or interfere with the diversification objective.	Consistent.
AG-2.3: Support Organic Agriculture. Encourage organic agricultural production, including field crops and animal agriculture, as a means to increase on-farm income, diversity Marin County agriculture, and provide healthy food for the local supply.	The project does not interfere with the county's objective of supporting organic agriculture.	Consistent.
AG-2.4: Expand Agricultural Processing. Encourage processing and distribution of locally produced foods to support local food security and strengthen Marin County's agricultural industry.	The project does not interfere with the objective of expanding agricultural processing in the county.	Consistent.

Plan Policy	Consistency Analysis: Discussion	Consistency Analysis: Conclusion, Including Recommendations to Eliminate Inconsistencies
AG-2.5: Promote Small-Scale Crop Production. Encourage small-scale row crop production that contributes to local food security on appropriate sites throughout the County.	The project does not interfere with the objective of promoting small-scale crop production.	Consistent.
AG-2.7: Facilitate the Generational Transfer of Agricultural Land. Encourage and support transfer through inheritance, sale, or lease of agricultural properties to future generations.	The San Francisco Zen Center's long-term protection of agricultural land will not be altered by this project.	Consistent.
Marin County Code		
Title 13—Roads and Bridges, Title 22—Development Code, Title 23—Natural Resources, Title 24—Development Standards	The code focuses on development and infrastructure projects. Other than the activities along Pacific Way and around the project's perimeter, this project would have limited development orientation. Code is consistent with other, older overarching regulations and policies.	Consistent.

Restoration Alternatives

Table 4.3.4.6-2 summarizes the potential impacts of Restoration Alternatives to land use and agriculture. The Restoration Alternatives are described in Chapter 2.

Table 4.3.4.6-2. Land Use and Agriculture Impacts from Restoration Alternatives

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact: Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	Mitigation Measure
LU-R1: Conversion of Agricultural Land to Non-Agricultural Use.	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	
LU-R2: Consistency with Land Use Policies Related to Agriculture	Negligible	Negligible	Negligible	Negligible	

Impact LU-R1: Conversion of Agricultural Land to Non-Agricultural Use (long-term, Years 5 and 50)

The project is not located in an area designated as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, nor is it under a Williamson Act contract. All of the action alternatives would involve removal of a small portion of Green Gulch Field 7, which is used by Golden Gate Dairy to pasture horses. The removal would reduce the capacity of the field from 4 horses to 3 horses.

Restoration Alternative 1: Negligible. No actions would be taken that would affect agriculture.

Restoration Alternatives 2, 3, 4: Minor Adverse. The loss of one horse from Green Gulch Field 7 is a minimal loss and would not compromise the viability of horse boarding operations in the area.

Impact LU-R2: Consistency with Land Use Policies Related to Agriculture (long-term, Years 5 and 50)

The 1994 Countywide Plan and 2006 draft Countywide Plan contain numerous policies related to preserving agriculture. As described under Impact LU-R1, the project would reduce the size of Green Gulch Field 7 slightly. This is not a substantial effect from the standpoint of agricultural conversion, and is not considered inconsistent with the following policies from the Countywide Plan:

- **AG-1.2:** Encourage Contractual Protection. Facilitate agricultural conservation easements, land conservation and farmland security zone contracts, and transfer of development rights.
- **AG-1.3:** Preserve Agricultural Zoning. Maintain very low-density agricultural zoning in the Coastal Recreation Corridors to support land-extensive agricultural production and discourage conversion to non-agricultural uses.
- **AG-1.4:** Limit Non-Agricultural Zoning. Apply non-agricultural zoning only in areas where conflicts with agricultural uses will be minimized, and ensure that development standards preserve and enhance nearby agricultural uses.
- **AG-1.5:** Discourage Subdivision of Agricultural Lands. Allow subdivision of agricultural land only upon demonstration that long-term agricultural production on a specific parcel will be enhanced through the proposed subdivision.
- **AG-1.6:** Limit Non-Agricultural Development. Limit non-agricultural development in the Agricultural Production Zone to allowed residential and accessory uses incidental to and compatible with agricultural production.
- **AG-1.7:** Limit Ancillary Non-Agricultural Land Uses. Require non-agricultural land uses on agricultural lands to be ancillary, subordinate to, and compatible with, agricultural land uses, agricultural production, and the rural character of the area, and to enhance the economic viability of agricultural operations.

- **AG-1.8:** Maintain the Agricultural Land Base. Encourage private and public owners of lands that have traditionally been used for agriculture to keep land in agricultural use by continuing existing agricultural uses and developing compatible new agricultural uses.
- **AG-1.10:** Protect Productive Agricultural Soils. Discourage of prohibit buildings, impermeable surfaces, or other non-agricultural uses on soils classified by the Natural Resources Conservation Service as Prime Farmland or Farmland of Statewide Importance.
- **AG-1.12:** Expand Water Supplies. Support the development of water supplies for row crop production provided it does not degrade aquatic resources, especially in areas on soils classified as Prime Farmland or Farmland of Statewide Importance.
- **AG-2.1:** Promote Organic Certification. Support Marin Organic Certified Agriculture (MOCA) to perform local organic farm certification to comply with National Organic Program (NOP) standards.
- **AG-2.2:** Promote Small-Scale Diversification. Diversify agricultural uses and products on a small percentage of agricultural lands to complement existing traditional uses, help ensure the continued economic viability of the county agricultural industry, and provide increased food security.
- **AG-2.3:** Support Organic Agriculture. Encourage organic agricultural production, including field crops and animal agriculture, as a means to increase on-farm income, diversity Marin County agriculture, and provide healthy food for the local supply.
- **AG-2.4:** Expand Agricultural Processing. Encourage processing and distribution of locally produced foods to support local food security and strengthen Marin County's agricultural industry.
- **AG-2.5:** Promote Small-Scale Crop Production. Encourage small-scale row crop production that contributes to local food security on appropriate sites throughout the County.
- **AG-2.7:** Facilitate the Generational Transfer of Agricultural Land. Encourage and support transfer through inheritance, sale, or lease of agricultural properties to future generations.

- ~~**EQ4.7b:** This policy encourages use of contracts to preserve and maintain portions of the open space corridor in their present dairying and ranching uses.~~
- ~~**CD-8.9:** This policy requires designations of land for agriculture and conservation where it has resource value for both agricultural production and for wetland and wildlife habitat.~~
- ~~**CD-15.1**: This policy requires that the County designate and maintain lands for agriculture at low densities in the Coastal Recreation Corridor.~~
- ~~**A-1.1:** This policy requires that agricultural lands be preserved by maintaining agricultural parcels in sizes large enough to sustain agricultural~~

~~production, avoiding conversion of agricultural land to non-agricultural uses, discouraging uses that are not compatible with long-term agricultural productivity, and encouraging programs that assist agricultural operators and owners in maintaining the agricultural productivity of their land and marketing their products.~~

- ~~**A-1.5:** This policy requires the County to encourage the acquisition or dedication of perpetual agricultural conservation easements.~~
- ~~**A-1.9:** This policy requires the County to support the continued agricultural operations and agricultural land uses within the "pastoral zones" of the Golden Gate National Recreation Area.~~

Restoration Alternative 1: Negligible. No actions would be taken that would be inconsistent with agricultural land use policies.

Restoration Alternatives 2, 3, 4: Negligible. The project would be consistent with County policies related to preservation of agricultural lands and dedication of agricultural conservation easements.

Public Access Alternatives

Table 4.3.4.6-3 summarizes the potential impacts of Public Access Alternatives to water quality. The Public Access Alternatives are described in Chapter 2.

Table 4.3.4.6-3. Land Use and Agriculture Impacts from Public Access Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							
Impact	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	Mitigation Measure
LU-P1: Consistency with Land Use Policies Related to Trails	Negligible	**Moderate Adverse**	**Moderate Adverse**	Negligible	Negligible	Negligible	**Moderate Adverse**	No mitigation available.

Impact LU-P1: Consistency with Land Use Policies Related to Trails (long-term, Years 5 and 50)

The 1994 Countywide Plan contained Policy TR-3.5, which requires that parking needs be addressed at trailheads. Public access alternatives that would reduce parking lot size would not be consistent with this policy. Note that no such policy exists in the 2007 Countywide Plan, and as such, none of the alternatives would be inconsistent with the new plan.

Public Access Alternatives A, B3, B4, B5: Negligible. Parking capacity would be maintained or increased.

Public Access Alternatives B1, B2, C: Moderate Adverse. All of these alternatives would reduce parking lot capacity. This is a significant and unavoidable aspect of alternative design.

Bridge Alternatives

The Bridge Alternatives would not affect land use or agricultural resources. Therefore, there would be no impacts related to land use or agriculture as a result of the Bridge Alternatives.

Fill Disposal Alternatives

The Fill Disposal Alternatives would not affect land use or agricultural resources. Therefore, there would be no impacts related to land use or agriculture as a result of the Fill Disposal Alternatives.

4.3.4.7 Noise

Guiding Regulations and Policies

Federal Regulations

National Park Service Regulations. National Park Service guidance regarding noise is found primarily in two documents—*Interim Technical Guidance on Assessing Impacts* and *Impairment to Natural Resources and Environmental Impact Methodologies and Thresholds*. These documents suggest methods to be used in evaluating project-related noise impacts and potential impairment to the natural soundscape. These methods are based on detailed noise monitoring, quantification of noise from the proposed action plus all other sources of noise that may affect the park, and the contribution of the proposed action to the overall park soundscape. In addition to the two documents above, the National Park Services' Management Policies (2006a) document states that the National Park Service will preserve, to the greatest extent possible, the natural soundscapes of parks. Preservation techniques will include protecting natural soundscapes from unacceptable impacts and restoring wherever possible park soundscapes that have become degraded by unnatural sounds (noise) to the natural condition.

State Regulations

California General Plan Guidelines. California Government Code Section 65302(f) requires that cities and counties include a noise element in their general plans. The purpose of the noise element is to provide a guide for establishing a pattern of land uses that minimizes the exposure of community residents to excessive noise. The Office of Planning and Research has published general plan guidelines that include guidelines for noise land use compatibility (Table 4.3.4.7-1).

Local Regulations and Standards

The proposed project is located within Marin County. Marin County has established policies and regulations concerning the generation and control of noise that could adversely affect its citizens and noise-sensitive land uses. The General Plan is a document required by state law that serves as the County's "blueprint" for land use and development. The noise element of the General Plan contains planning guidelines relating to noise and identifies goals and policies to support achievement of those goals. Noise element guidelines relate primarily to land use compatibility with noise sources that are regulated at the local level, such as traffic, aircraft, and trains.

The noise ordinance, part of the municipal code, is the primary noise enforcement tool for noise generated by locally regulated noise sources such as mechanical equipment and construction activity.

The following is a brief discussion of the General Plan policies and noise ordinance regulations implemented by Marin County and City of Novato

(relevant to hauling of excess fill material to the Hamilton wetlands restoration project) to protect its citizens from the adverse impacts of noise.

County of Marin General Plan Noise Element. The County's Noise Element establishes policies and regulations concerning the generation and control of noise that could adversely affect its citizens and noise-sensitive land uses. The County's Land Use Compatibility Noise Standards for development and transportation projects are summarized in Table 4.3.4.7-2, while the County's noise standards for stationary noise sources are summarized in Table 4.6.7-3. The County's Noise Element indicates that residential, public, and institutional land uses should not be subjected to noise levels above 60 dBA, L_{dn} as a result of stationary sources. In commercial areas, the acceptable noise level related to stationary sources is 65 dBA, L_{dn}, while the acceptable noise level in agricultural and industrial areas is 70 dBA, L_{dn}.

Table 4.3.4.7-3. Marin County Allowable Noise Exposure from Stationary Noise Sources

	Daytime (7:00 a.m. to 10:00 p.m.)	Nighttime (10:00 p.m. to 7:00 a.m.)
Hourly dB (L_{eq})	50	45
Maximum Level	70	65
Maximum level (Impulsive Noise)	65	60
Source: Marin County 1994		

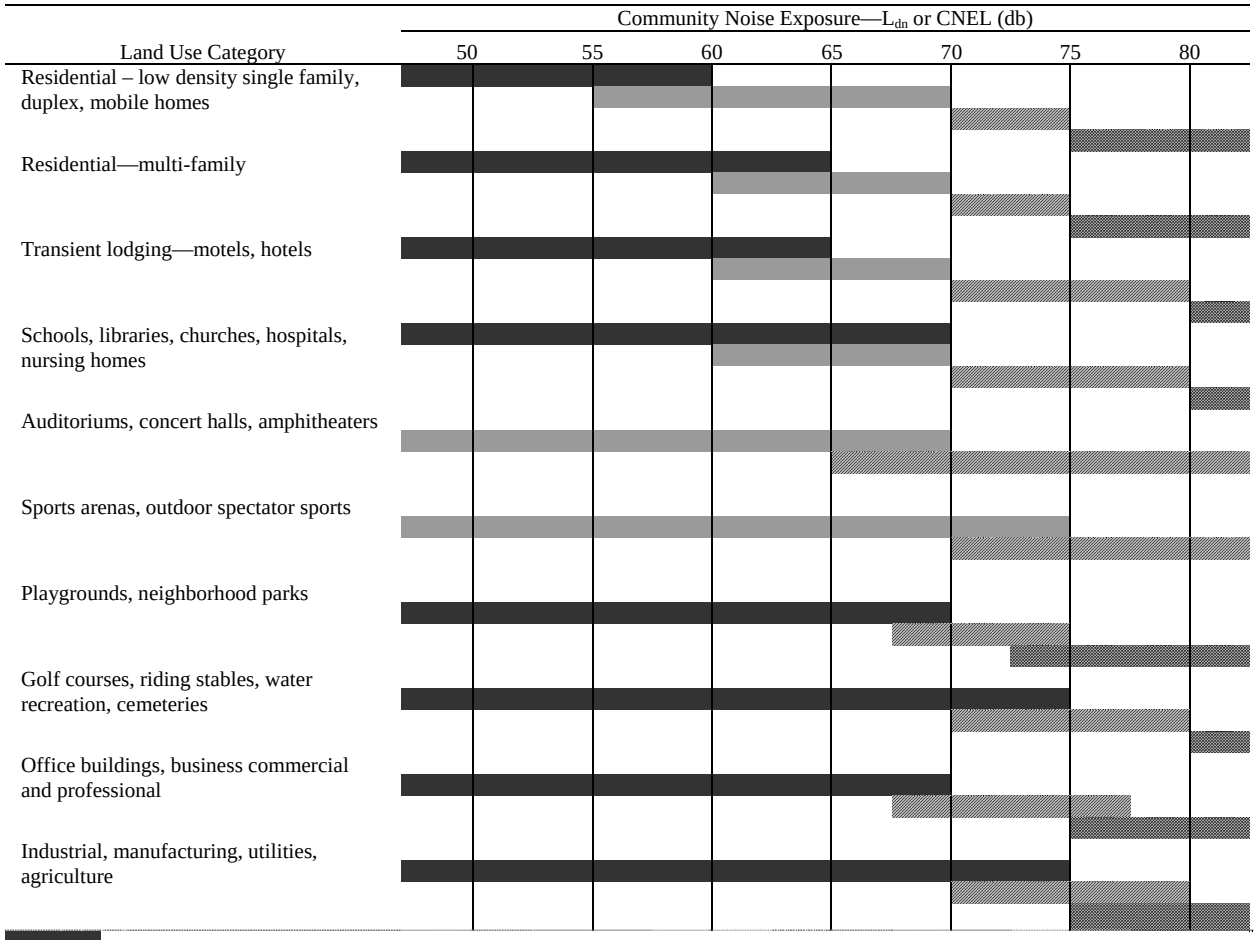
Program N-2.4a from the County's Noise Element restricts the hours of construction to times of the day during which noise would not normally disturb noise-sensitive land uses. The County's Planning Division has indicated that, typically, construction hours are determined on a project-by-project basis, but are typically between the hours of 8:00 a.m. to 5:00 p.m., Monday through Friday and 9:00 a.m. to 4:00 p.m., Saturday. No construction is typically allowed on Sunday.

County of Marin County Code. The County's noise ordinance prohibits the generation of any noise that annoys, disturbs, injures, or endangers the comfort, repose, health, or peace of others.

Study Area

The study area includes the entire project area and surrounding noise-sensitive land uses, as well as the fill disposal haul routes. The project area and associated noise-sensitive land uses are described in Chapter 3, Section 3.4.7 *Noise*, and is shown on Figure 2-3.

Table 4.3.4.7-1. State Land Use Compatibility Standards for Community Noise Environments



Normally Acceptable
Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable
New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features are included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

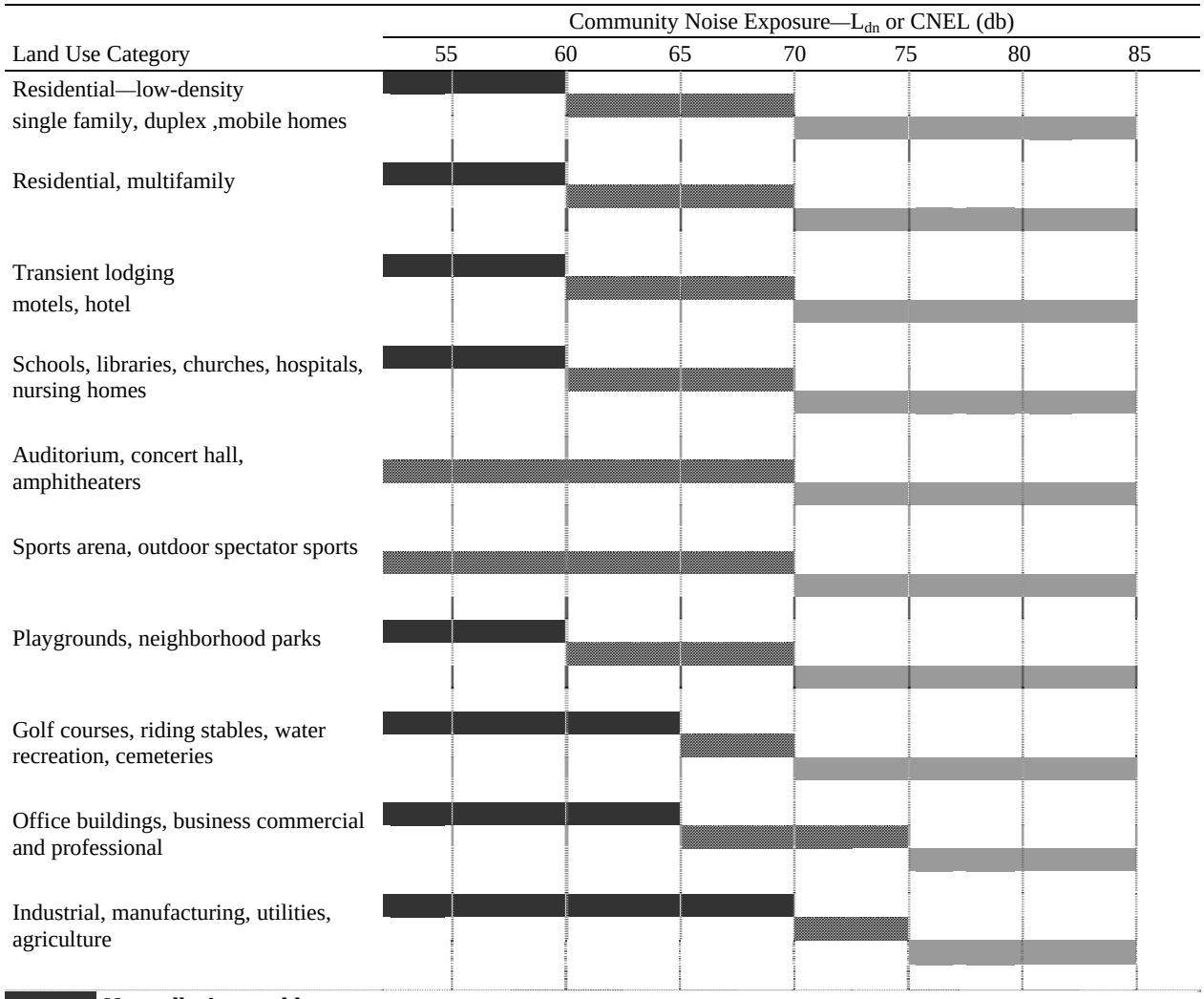
Normally Unacceptable
New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

Clearly Unacceptable
New construction or development generally should not be undertaken.

Source: California Governor's Office of Planning and Research 2003.

Exhibit 2: Final Environmental Impact Statement

Table 4.3.4.7-2. Marin County Land Use Compatibility Standards for Community Noise Environments



Normally Acceptable:
Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable:
New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems will normally suffice.

Normally Unacceptable:
New construction of development should be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirement must be made and needed noise insulation features included in the design.

Source: Marin County 1994.

Notes:

Noise Source Characteristics: The land use/noise compatibility recommendations should be viewed in relation to the specific source of the noise. For example, aircraft and railroad noise is normally made up of higher single-noise events than auto traffic, but occurs less frequently. Therefore, different sources yielding the same composite noise exposure do not necessarily create the same noise environment.

Suitable Interior Environments: One objective of locating (both single and multifamily) residential units relative to a known noise source is to maintain a suitable interior noise environment at no grater than 45 dB CNEL or L_{dn}. This requirement, coupled with the measured or calculated noise reduction performance of the type of structure under consideration, should govern the minimum acceptable distance to a noise source.

Exhibit 2: Final Environmental Impact Statement

Analysis Thresholds

The following thresholds were used to determine noise impacts.

- **Negligible:** Natural sounds would prevail; construction or operational noise would be very infrequent or absent, mostly unmeasurable.
- **Minor:** Natural sounds would predominate, with construction noise infrequent at low levels. Traffic or parking lot noise would be less than 60 dBA at the nearest noise-sensitive land use during the daytime.
- **Moderate:** Construction noise would predominate during daylight hours and would not be overly disruptive to noise-sensitive land uses in the area; in such areas, natural sounds could still be heard occasionally. Traffic or parking lot noise would be less than 65 dBA at the nearest noise-sensitive land use during the daytime.
- **Major:** Natural sounds would be impacted by construction noise sources frequently or for extended periods of time. The natural soundscape would be impacted most of the day; noise would disrupt conversation for long periods of time; and/or make enjoyment of other activities in the area difficult; natural sounds would rarely be heard during the day. Traffic or parking lot noise would exceed 70 dBA at the nearest noise-sensitive land use during the daytime.

Methods and Assumptions

The Federal Transit Administration (FTA) has developed methodology for the evaluation of construction and operational noise impacts (Federal Transit Administration 1995). Evaluation of construction noise impacts considers information pertaining to:

- the types of construction equipment operating and associated noise emission levels,
- distance from receiver to construction equipment,
- effects of topography and ground to noise propagation, and
- period of operation of equipment.

Evaluation of operation noise impacts considers anticipated number of vehicles and vehicular traffic. NPS also has described methods for the evaluation of noise impacts and potential impairment to the natural soundscape in the following documents.

- *Interim Technical Guidance on Assessing Impacts and Impairment to Natural Resources* (National Park Service 2003).
- *Environmental Impact Methodologies and Thresholds* (National Park Service 2004).

These methods are based on detailed noise monitoring, quantification of noise from a proposed project plus all other sources of noise that may affect the project, and the contribution of a proposed project to the overall soundscape.

Given the limited nature of operational noise from the project (i.e., the absence of substantial long-term noise generating activities, other than construction), an assessment of operational noise at a high level of detail is not warranted. Rather the project is evaluated at a level of detail that is both consistent the scope of the project and the intent of the NPS guidelines. To determine noise impacts, the following methods and assumptions were used.

- Construction-related impacts were evaluated based on NPS guidelines (National Park Service 2003). This included evaluation of the types of construction equipment operating and associated noise emission levels, distance from receiver to construction equipment, effects of topography and ground to noise propagation, and period of operation of equipment.
- Noise from construction-related vehicular traffic was assessed using FHWA's Traffic Noise Model, Version 2.5 (TNM 2.5) Look-Up Tables. The model estimates traffic noise levels based on roadway geometrics; traffic volumes for automobiles, medium trucks (vehicles with two axles and six tires), and heavy trucks (vehicles with three or more axles); vehicle speeds; and a noise attenuation rate parameter.

Noise from parking lot activities was assessed based on anticipated number of vehicles accessing the parking lot per hour, which was obtained using traffic data provided in the transportation analysis (DKS Associates 2005) and methodology developed by the FTA. A detailed inventory of construction equipment that will be used for the project was not available; therefore, this noise analysis is based on anticipated construction equipment that will be used during earthmoving and construction activities. Table 4.3.4.7-4 presents a list of noise generation levels for the anticipated equipment inventory that may be used during various construction activities associated with project alternatives. The list, compiled by the FTA (1995) and predictive calculations developed by the City of Boston to regulate construction noise during that City's "Big Dig" construction project (Massachusetts Turnpike Authority 2000 in Thalheimer 2000) were used in this analysis to estimate construction noise. A reasonable worst-case assumption is that the three loudest pieces of equipment for each phase would operate simultaneously and continuously over at least a 1-hour period for a combined source noise level.

The analysis assumes that all construction would be conducted between 8:00 a.m. and 5:00 p.m., Monday through Friday, and 9:00 a.m. and 4:00 p.m. on Saturdays, with no construction activity allowed on Sundays.

Table 4.3.4.7-4. Construction Equipment Noise Emission Levels

Equipment	Typical Noise Level 50 feet from Source (dBA)
Backhoe	80
Compactor	82
Crane, Derrick	88
Crane, Mobile	83
Excavator	85
Grader	85
Jack Hammer	88
Loader	85
Paver	89
Pile Driver (Impact)	101
Pile Driver (Sonic)	96
Roller	74
Scraper	89
Truck	88

Source: Federal Transit Administration 1995, Massachusetts Turnpike Authority 2000 in Thalheimer 2000

Restoration Alternatives

Table 4.3.4.7-5 summarizes the potential impacts of the Restoration Alternatives on noise. The Restoration Alternatives are described in Chapter 2.

Table 4.3.4.7-5. Potential Noise Impacts from the Restoration Alternatives

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact				Mitigation Measure
	Rest Alt 1	Rest Alt 2	Rest Alt 3	Rest Alt 4	
NZ-R1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Construction Activities	Negligible	**Moderate Adverse /Moderate Adverse**	**Moderate Adverse /Moderate Adverse**	**Moderate Adverse /Moderate Adverse**	NZ-MM-1: Employ Noise-Reducing Construction Practices NZ-MM-2: Prepare a Noise Control Plan NZ-MM-3: Disseminate Essential Information to Residences and Implement a Complaint/Response Tracking Program
NZ-R2: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise During the Lifetime of the Restoration	Minor Adverse	Negligible	Negligible	Negligible	

Impact NZ-R1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Construction Activities (Short-Term, Year 0)

Noise from construction activities includes noise from grading, excavation, and other earthmoving activities. Additionally, construction noise also results from machinery and equipment used in the construction process. This noise analysis is based on anticipated construction equipment that will be used during earthmoving and construction activities. For construction of the Restoration Alternatives, it was assumed that construction equipment would include a backhoe, compactor, crane, derrick, crane, mobile, excavator, jack hammer, loader, roller, scraper, and truck. Table 4.3.4.7-4 presents a list of noise generation levels for the anticipated equipment inventory that may be used during construction activities associated with the proposed project. Based on the noise levels presented in Table 4.3.4.7-4, Table 4.3.4.7-6 calculates estimated sound levels from construction activities as a function of distance assuming simultaneous operation of a scraper, jack hammer, and truck for a combined source level of 93 dBA at 50 feet. The magnitude of construction noise impacts was assumed to depend on the type of construction activity, the noise level generated by various pieces of construction equipment, and the distance between the activity and noise sensitive receivers. The calculations in Table 4.3.4.7-6 are based on an attenuation rate of 6 dB per doubling of distance. Any shielding effects that might result from local barriers (including topography) are not included, thus making the analysis conservative. Additional attenuation from ground absorption is considered because the area is generally softscape.

Table 4.3.4.7-6. Estimated Construction Noise in the Vicinity of an Active Construction Site

Entered Data:			
Construction Condition: Site leveling			
Source 1: Scraper – Sound level (dBA) at 50 feet =		89	
Source 2: Jack hammer – Sound level (dBA) at 50 feet =		88	
Source 3: Truck – Sound level (dBA) at 50 feet =		88	
Average Height of Sources – Hs (ft) =		10	
Average Height of Receiver – Hr (ft.) =		5	
Ground Type (soft or hard) =		Soft	
Calculated Data:			
All Sources Combined – Sound level (dBA) at 50 feet =		93	
Effective Height (Hs+Hr)/2 =		7.5	
Ground factor (G) =		0.62	
Distance Between Source and Receiver (ft.)	Geometric Attenuation (dB)	Ground Effect Attenuation (dB)	Calculated Sound Level (dBA)
50	0	0	93
100	-6	-2	85
250	-14	-4	75
300	-16	-5	73
400	-18	-6	70
500	-20	-6	67
600	-22	-7	65
700	-23	-7	63
800	-24	-7	62
900	-25	-8	60
1000	-26	-8	59
1200	-28	-9	57
1400	-29	-9	55
1600	-30	-9	54
1800	-31	-10	52
2000	-32	-10	51

Distance Between Source and Receiver (ft.)	Geometric Attenuation (dB)	Ground Effect Attenuation (dB)	Calculated Sound Level (dBA)
2500	-34	-10	49
3500	-37	-11	45
5280	-40	-12	40

Source: Calculations based on FTA 1995.

Notes: This calculation does not include the effects, if any, of local shielding that may reduce sound levels further.

Restoration Alternative 1: Negligible. No construction activities would occur. Noise associated with periodic maintenance dredging is discussed below under Impact NZ-R2.

Restoration Alternatives 2, 3, 4: Moderate Adverse. The impacts of the interim flood reduction measures would be similar to those described for periodic maintenance dredging under Restoration Alternative 1 in Impact NZ-R2.

Construction activities associated with the restoration actions would expose nearby noise-sensitive land uses to noise over 3 to 4 years of seasonal construction, with longer durations applying to the alternatives requiring more extensive construction activities (i.e., Alternatives 3 and 4). Table 4.6.7-6 indicates that noise levels within 50 feet of construction could be as high as 93 dBA, L_{eq}. It bears noting that the more intensive alternatives (Alternatives 3 and 4) would be likely to generate such noise levels more frequently.

Construction noise would only be generated seasonally, would be of varying intensity depending upon the phase of construction and location of construction with respect to noise-sensitive land uses, and would be limited to a duration of 3 to 4 years. Further, noise-sensitive land uses in locations that are relatively distant from the site, such as the buildings at Green Gulch Farm, which are approximately 2000 feet or more from the project site, would not experience substantial noise impacts. Impacts are considered moderate adverse overall, and are significant. Implementation of mitigation measures NZ-MM-1 through NZ-MM-3 would reduce these impacts, but due to the duration of construction, not to a less-than-significant level.

Noise from construction activities may also adversely impact birds, horses, and other animals in the immediate vicinity of construction activities. Horses and birds may experience temporary annoyance and discomfort when initial construction activities occur. However, as they acclimate to the noise, impacts to these animals are anticipated to minimize. In addition, mitigation measures NZ-MM-1 through NZ-MM-3 would minimize these impacts.

Impact NZ-R2: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise During the Lifetime of the Restoration (Long-Term, Years 5 and 50)

Restoration Alternative 1: Minor adverse. Periodic maintenance dredging would be possible under the No Action Alternative. Data from Geier & Geier

Consulting (1997) indicate that noise from clamshell dredging operations is approximately 84 dBA at a distance of 50 feet. Noise from dredging activities could potentially result in and adverse noise impact to nearby noise-sensitive land uses. Noise-sensitive land uses, such as the Pelican Inn and the homes along Lagoon Way, are located in close proximity to the likely locations of dredging. Although noise associated with maintenance dredging could exceed levels associated with the thresholds for moderate or major impacts, the infrequency and short duration of such activities would be more consistent with the threshold for a negligible impact. Impacts overall are therefore considered minor adverse.

Restoration Alternatives 2, 3, 4: Negligible. The Restoration Alternatives themselves are not anticipated to result in generation of noise.

Public Access Alternatives

Table 4.3.4.7-7 summarizes the potential impacts of the Public Access Alternatives on noise. The Public Access Alternatives are described in Chapter 2

Table 4.3.4.7-7. Potential Noise Impacts from the Public Access Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							
Impact	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	Mitigation Measure
NZ-P1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Parking Lot Construction	Negligible	**Moderate Adverse** /Minor Adverse	**Moderate Adverse** /Minor Adverse	**Moderate Adverse** /Minor Adverse	**Moderate Adverse** /Minor Adverse	**Moderate Adverse** /Minor Adverse	**Moderate Adverse** /Minor Adverse	NZ-MM-1: Employ Noise-Reducing Construction Practices NZ-MM-2: Prepare a Noise Control Plan NZ-MM-3: Disseminate Essential Information to Residences and Implement a Complaint/Response Tracking Program
NZ-P2: Exposure of Noise-Sensitive Land Uses (Residents and	Negligible	Minor Beneficial	Minor Beneficial	Negligible	Negligible	Minor Adverse	Minor Beneficial	

Impact	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact							Mitigation Measure
	Pub Access Alt A	Pub Access Alt B1	Pub Access Alt B2	Pub Access Alt B3	Pub Access Alt B4	Pub Access Alt B5	Pub Access Alt C	
Visitors) to Elevated Levels of Noise from Use of the Parking Lot								
NZ-P3: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Roadway Noise	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	

Impact NZ-P1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Parking Lot Construction (Short-Term, Year 0)

Impact mechanisms would generally be the same as described for Impact NZ-R1, and the impact analysis assumes the same combination of construction equipment as under that impact discussion. The nearest noise-sensitive land uses that would be exposed to construction noise from the parking lot would be residents along Pacific Way (and in the case of Public Access Alternative C, residents near the remote lot), and park visitors. Other aspects of the Public Access Alternatives (e.g., the trail from Hwy 1 to the parking lot) would expose other noise-sensitive land uses (e.g., Pelican Inn).

Public Access Alternative A: Negligible. No construction activities would occur.

Public Access Alternatives B1, B2, B3, B4, B5, C: Moderate Adverse. Construction would expose nearby noise-sensitive land uses to noise over 2 years of seasonal construction. Table 4.3.4.7-6 indicates that noise levels within 50 feet of construction could be as high as 93 dBA, L_{eq}. Although Public Access Alternatives B1, B2, B3, B4, B5, and C differ in total area and number of parking spaces, it is anticipated that this would not affect the number of equipment pieces required to construct each alternative. It is assumed that the same number of equipment pieces would be required to construct all alternatives, although the duration of construction may vary somewhat depending upon the alternative.

Construction noise would only be generated seasonally, would be of varying intensity depending upon the phase of construction and location of construction with respect to noise-sensitive land uses, and would be limited to a duration of 2 years. Impacts are considered moderate adverse and significant, but due to their short-term nature, are mitigable to a less-than-significant level through implementation of mitigation measures NZ-MM-1 through NZ-MM-3.

Noise from construction activities may also adversely impact birds, horses, and other animals in the immediate vicinity of construction activities. Horses and birds may experience temporary annoyance and discomfort when initial construction activities occur. However, as they acclimate to the noise, impacts to these animals are anticipated to minimize. In addition, mitigation measures NZ-MM-1 through NZ-MM-3 would minimize these impacts.

Impact NZ-P2: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Use of the Parking Lot (Long-Term, Years 0 and 50).

Noise associated with use of the parking lots includes noise from vehicles vehicular traffic accessing the parking lots, noise associated with recreational use of the park facilities (i.e., music, dogs, people shouting and raising their voices, etc.). Noise from vehicles accessing the parking lot noise is assessed using methodology developed by the Federal Transit Administration (Federal Transit Administration 1995) based on the number of parking spaces available under each alternative.

This methodology evaluates noise typically associated with parking lot activities, including engine noise from vehicles entering and exiting the lot, vehicles driving through the parking lot, and the opening and closing of vehicle doors. Additional noise sources associated with the parking lot include occasional horn honking from driver interactions and rare instances of tire screeching. However, these types of noise sources are intermittent and are not representative of the typical noise environment associated with a parking lot. For the analysis of parking lot noise, it was assumed that all of the parking spaces available under each alternative would be accessed in one hour.

Public Access Alternative A: Negligible. Use of the parking lot would continue as under current conditions. Under Public Access Alternative A, the parking lot would retain is 175-car capacity and current configuration. Assuming a worst-case scenario that all parking spaces would be accessed in one hour, this would correspond to an hourly noise level of 55 dBA, L_{eq}, which is well below the noise threshold of 60 dBA. In addition, noise levels would even be lower at the nearest noise sensitive land uses due to noise attenuation due to distance.

Public Access Alternative B1: Minor Beneficial. Under Public Access Alternative B1, the parking lot would consist of 50 spaces. Assuming a worst-case scenario that all parking spaces would be accessed in one hour, this would correspond to an hourly noise level of 49 dBA, L_{eq}, which is well below the noise threshold of 60 dBA, and 6 dB less than the existing parking lot configuration under Public Access Alternative A. In addition, noise levels would even be lower

at the nearest noise sensitive land uses resulting from noise attenuation due to distance.

Public Access Alternative B2: Minor Beneficial. Under Public Access Alternative B2, the parking lot would consist of 145 spaces. Assuming a worst-case scenario that all parking spaces would be accessed in one hour, this would correspond to an hourly noise level of 54 dBA, L_{eq}, which is well below the noise threshold of 60 dBA, and 1 dB less than the existing parking lot configuration under Public Access Alternative A. In addition, noise levels would even be lower at the nearest noise sensitive land uses resulting from noise attenuation due to distance.

Public Access Alternatives B3, B4: Negligible. Under Public Access Alternatives B3 and B4, the parking lot would consist of 175 spaces, which is consistent with the existing parking lot configuration under Public Access Alternative A. Assuming a worst-case scenario that all parking spaces would be accessed in one hour, this would correspond to an hourly noise level of 55 dBA, L_{eq}, which is well below the noise threshold of 60 dBA, and similar to noise from the existing parking lot configuration under Public Access Alternative A. In addition, noise levels would even be lower at the nearest noise sensitive land uses resulting from noise attenuation due to distance. While Public Access Alternative B4 would situate the parking lot closer to existing residences along Pacific Way, noise levels would still remain below the noise threshold of 60 dBA at these residences.

Public Access Alternative B5: Minor adverse. Under Public Access Alternative B5, the parking lot would consist of 200 spaces. Assuming a worst-case scenario that all parking spaces would be accessed in one hour, this would correspond to an hourly noise level of 55 dBA, L_{eq}, which is well below the noise threshold of 60 dBA, and similar to noise from the existing parking lot configuration under Public Access Alternative A. In addition, noise levels would even be lower at the nearest noise sensitive land uses resulting from noise attenuation due to distance. While Public Access Alternative B5 would situate the parking lot closer to existing residences along Pacific Way, noise levels would still remain below the noise threshold of 60 dBA at these residences.

Public Access Alternative C: Minor Beneficial. Under Public Access Alternative C, the parking lot would consist of 118 spaces. Assuming a worst-case scenario that all parking spaces would be accessed in one hour, this would correspond to an hourly noise level of 53 dBA, L_{eq}, which is well below the noise threshold of 60 dBA, and 2 dB less than the existing parking lot configuration under Public Access Alternative A. In addition, noise levels would even be lower at the nearest noise sensitive land uses resulting from noise attenuation due to distance and the remote location of the parking lot.

Impact NZ-P3: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Roadway Noise (Long-Term, Years 0 and 50).

Public Access Alternative A: Negligible. Use of the parking lot would continue as under current conditions. Under Public Access Alternative A, the parking lot would retain its 175-car capacity and current configuration, and access to the parking lot would continue as under existing conditions. Consequently, Alternative A would not result in elevated levels of roadway noise.

Public Access Alternatives B1, B2, B3, B4, B5, C: Negligible. It is anticipated that traffic volumes would not differ between Alternative A and the action alternatives; it is also assumed that the action alternatives would not generate additional traffic volumes. Although a parking shortfall currently occurs under existing conditions, is anticipated that this shortfall will continue under the action alternatives, to varying extents depending upon parking lot capacity. The result of the parking shortfall is that cars will continue to access the parking lot and drive away if no spaces are found. The major difference in roadway noise associated with the alternatives would therefore be that generated by vehicles that are waiting in queue or circling the lot looking for a parking space. This is not anticipated to result in substantially different noise levels between the various alternatives.

Bridge Alternatives

Table 4.3.4.7-8 summarizes the potential impacts of the Bridge Alternatives on noise. The Bridge Alternatives are described in Chapter 2.

Table 4.3.4.7-8. Potential Noise Impacts from the Bridge Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Bridge Alt BR0	Bridge Alt BR1	Bridge Alt BR2	Bridge Alt BR3	Bridge Alt BR4	Mitigation Measure
NZ-B1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Typical Construction Activities	Negligible	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse/** Minor Adverse	**Moderate Adverse**/ Minor Adverse	**Moderate Adverse**/ Minor Adverse	NZ-MM-1: Employ Noise-Reducing Construction Practices NZ-MM-2: Prepare a Noise Control Plan NZ-MM-3: Disseminate Essential Information to Residences and Implement a Complaint/Response Tracking Program
NZ-B2: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Pile Driving	Negligible	**Major Adverse/ Moderate Adverse**	**Major Adverse/ Moderate Adverse**	**Major Adverse/ Moderate Adverse**	**Major Adverse/ Moderate Adverse**	NZ-MM-1 NZ-MM-2 NZ-MM-3
NZ-B3: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise During Operation of the Bridge	Negligible	Negligible	Negligible	Negligible	Negligible	

Impact NZ-B1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Typical Construction Activities (Short-Term, Year 0)

Impact mechanisms would generally be the same as described for Impact NZ-R1, and for typical construction activities associated with the bridge, the impact analysis assumes the same combination of construction equipment as under that impact discussion. The nearest noise-sensitive land uses that would be exposed to construction noise would be residents along Lagoon Drive (approximately 250 feet from the nearest construction activity), and the Pelican Inn (within 50 feet of

the nearest construction activity), as well as any pedestrians, bicyclists, etc. in the vicinity.

Bridge Alternative BR0: Negligible. Current conditions would continue under the No Action Alternative. No construction activities would occur as a result of Bridge Alternative BRO. Consequently, there are no impacts associated with this alternative.

Bridge Alternatives BR1, BR2, BR3, BR4: Moderate Adverse. Construction would expose nearby noise-sensitive land uses to noise over 1 to 2 years of seasonal construction. Table 4.3.4.7-6 indicates that noise levels within 50 feet of typical construction activities could be as high as 93 dBA, L_{eq}. Although the Bridge Alternatives differ in construction footprint, it is anticipated that this would not affect the number of equipment pieces required to construct each alternative. It is assumed that the same number of equipment pieces would be required to construct all alternatives, although the duration of construction may vary somewhat depending upon the alternative.

Construction noise would only be generated seasonally, would be of varying intensity depending upon the phase of construction, and would be limited to a duration of 1 to 2 years. Impacts are considered moderate adverse and significant, but due to their short term nature, are mitigable to a less-than-significant level through implementation of mitigation measures NZ-MM-1 through NZ-MM-3.

Noise from construction activities may also adversely impact birds, horses, and other animals in the immediate vicinity of construction activities. Horses and birds may experience temporary annoyance and discomfort when initial construction activities occur. However, as they acclimate to the noise, impacts to these animals are anticipated to minimize. In addition, mitigation measures NZ-MM-1 through NZ-MM-3 would minimize these impacts.

Impact NZ-B2: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Pile Driving (Short-Term, Year 0)

Additional noise could be generated as a result of pile driving activities for the bridge.

Bridge Alternative BR0: Negligible. Current conditions would continue under the No Action Alternative. No construction activities would occur as a result of Bridge Alternative BRO. Consequently, there are no impacts associated with this alternative.

Bridge Alternatives BR1, BR2, BR3, BR4: Major Adverse. Sensitive land uses located within approximately 1,700 feet of impact pile driving activities could be exposed to construction noise in excess of 60 dBA, L_{eq}. The extent of pile driving may differ somewhat between alternatives, with longer bridge spans resulting in greater need for pile driving. In addition, pile driving would only occur for a small portion of the overall bridge construction schedule.

Despite its short-term nature, pile driving is extremely loud, and anticipated noise levels associated with pile driving result in a determination that this is a major significant impact. Implementation of mitigation measures NZ-MM-1 through NZ-MM-3 would reduce impact, but not to a less-than-significant level.

Noise from pile driving may also adversely impact birds, horses, and other animals in the immediate vicinity of construction activities. These are also considered major significant impacts. In addition, mitigation measures NZ-MM-1 through NZ-MM-3 would minimize these impacts, but not to a less-than-significant level.

Impact NZ-B3: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise During Operation of the Bridge (Long-Term, Years 0 and 50)

Bridge Alternative BR0: Negligible. Current conditions would continue under the No Action Alternative. Vehicles would continue to access the parking lot via Pacific Way, and no operational changes would occur as a result of Bridge Alternative BR0. Consequently, there are no impacts associated with this alternative.

Bridge Alternatives BR1, BR2, BR3, BR4: Negligible. Bridge Alternatives BR1, BR2, BR3, and BR4 would change the location of the bridge, but would not change the alignment of Pacific Way or move the lanes of traffic closer to the nearest noise-sensitive land use (Pelican Inn). Consequently, Bridge Alternatives BR1, BR2, BR3, and BR4 would not change traffic noise levels at nearby noise sensitive land uses. There are no impacts associated with these alternatives.

Fill Disposal Alternatives

Table 4.3.4.7-9 summarizes the potential impacts of the Fill Disposal Alternatives on noise. The Fill Disposal Alternatives are described in Chapter 2

Table 4.3.4.7-9. Potential Noise Impacts from the Fill Disposal Alternatives

	Impact Level (before mitigation/after mitigation) **Bold** denotes a significant adverse impact					
Impact	Unused Reservoir Pit	Upper Banducci Field	Hamilton	Dias Ridge Trail*	Coastal Trail*	Mitigation Measure
Impact NZ-F1: Exposure of Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Fill Hauling and Disposal Activities	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	

* The analysis of the two trail alternatives only considers the effects of hauling the fill to the sites. For the coastal trail, impacts of using the fill to recontour the trail are also considered.

Impact NZ-F1: Exposure of Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Fill Hauling and Disposal Activities (Short-Term, Year 0)

Noise associated with fill disposal includes noise generated by trucks hauling and dumping fill, as well as any construction activities necessary to provide adequate access to the fill disposal site and/or process fill at the site. This analysis is based on assumed construction equipment of two loaders operating at the disposal sites, in addition to a maximum of 50 truck trips per day moving 500 cubic yards of material per day. Table 4.3.4.7-4 presents a list of noise generation levels for equipment that may be used during fill hauling and disposal activities associated with the proposed project.

Fill Hauling. Noise from haul trucks transporting excess materials off site to the final disposal site could expose noise sensitive land uses to traffic noise. As a worst case estimate, it was assumed that the proposed project would result in 50 round trips (100 total one-way trips) to the disposal site, which would equate to approximately 13 trips per hour. The FHWA's TNM 2.5 Look-Up Tables were used to evaluate traffic noise impacts from haul truck activities. Assuming an average speed of 35 miles per hour, Table 4.3.4.7-10 summarizes noise levels from haul trucks as a function of distance.

Table 4.3.4.7-10. Estimated Construction Noise from Haul Truck Activities[1]

Distance from Roadway Centerline (feet)	Noise Level (dBA, L_{eq})
50	59
100	56
200	53
250	51
300	50

Note:

[1] Assumed travel speed of 35 miles per hour

Fill Disposal. Table 4.3.4.7-11 calculates estimated sound levels from disposal activities as a function of distance assuming simultaneous operation of a three trucks for a combined source level of 93 dBA at 50 feet. The magnitude of fill disposal noise impacts was assumed to depend on the type of activity, the noise level generated by various pieces of construction equipment, and the distance between the activity and noise sensitive receivers. The calculations in Table 4.3.4.7-10 are based on an attenuation rate of 6 dB per doubling of distance. Any shielding effects that might result from local barriers (including topography) are not included, thus making the analysis conservative. Additional attenuation from ground absorption is considered because the area is generally softscape.

Table 4.3.4.7-11. Estimated Construction Noise in the Vicinity of an Active Construction Site

Entered Data:	
Construction Condition: Site leveling	
Source 1: Truck - Sound level (dBA) at 50 feet =	88
Source 2: Truck – Sound level (dBA) at 50 feet =	88
Source 3: Truck - Sound level (dBA) at 50 feet =	88
Average Height of Sources—Hs (ft) =	10
Average Height of Receiver—Hr (ft.) =	5
Ground Type (soft or hard) =	soft
Calculated Data:	
All Sources Combined—Sound level (dBA) at 50 feet =	93
Effective Height (Hs+Hr)/2 =	7.5
Ground factor (G) =	0.62

Distance Between Source and Receiver (ft.)	Geometric Attenuation (dB)	Ground Effect Attenuation (dB)	Calculated Sound Level (dBA)
50	0	0	93
100	-6	-2	85
250	-14	-4	74
300	-16	-5	72
400	-18	-6	69
500	-20	-6	67
600	-22	-7	65
700	-23	-7	63
800	-24	-7	61
900	-25	-8	60
1000	-26	-8	59
1200	-28	-9	57
1400	-29	-9	55
1600	-30	-9	53
1800	-31	-10	52
2000	-32	-10	51
2500	-34	-10	48
3500	-37	-11	45
5280	-40	-12	40

Source: Calculations based on Federal Transit Administration 1995.

Notes: This calculation does not include the effects, if any, of local shielding that may reduce sound levels further.

All Fill Disposal Alternatives: Minor Adverse. Table 4.3.4.7-9 indicates that hauling activities would not expose noise-sensitive land uses to truck noise in excess of 60 dBA, L_{eq}. While the intensity and duration of hauling would be greater for the Fill Disposal Alternatives that can accommodate a greater quantity of fill, this impact is nevertheless considered minor for these alternatives, because noise levels would not exceed the threshold for a moderate impact under any alternative.

Similarly, while Table 4.3.4.7-10 indicates that noise levels within 50 feet of typical fill disposal activities could be as high as 93 dBA L_{eq}, there are no noise-sensitive land uses in the vicinity of the fill disposal sites. While there are some residences near the Upper Banducci site, the site is an active agricultural area and is generally subject to similar types of noise as would be experienced as a result of fill disposal. Therefore, impacts are considered minor.

Mitigation Measures

NZ-MM-1: Employ Noise-Reducing Construction Practices

The construction contractor shall employ noise-reducing construction practices, including, but not limited to:

- As much as possible, limiting hours of construction operation to the hours between 8:00 a.m. and 5:00 p.m., Monday through Friday and 10:00 a.m. and 4:00 p.m. on Saturdays, and no construction allowed on Sundays,
- Locating equipment as far as practical from noise sensitive uses,
- Using sound control devices such as mufflers on equipment,
- Using equipment that is quieter than standard equipment,
- Prohibiting vehicles and other gas- or diesel-powered equipment from unnecessary warming up, idling, and engine revving,
- Selecting haul routes that affect the fewest number of people,
- Using noise-reducing enclosures around stationary noise-generating equipment,
- Shield/shroud any impact tools,
- Use vibratory pile driving in place of impact pile driving if feasible, and
- Pre-drill pile holes.

NZ-MM-2: Prepare a Noise Control Plan

The construction contractor shall prepare a detailed noise control plan based on the construction methods proposed. This plan will identify specific measurements that will be taken to minimize noise impacts, and ensure compliance with the identified noise limits where feasible. The noise control plan shall be reviewed and approved by NPS staff before any noise-generating construction activity begins.

NZ-MM-3: Disseminate Essential Information to Residences and Implement a Complaint/Response Tracking Program

The construction contractor shall notify any residences within 1000 feet of the construction areas of the construction schedule in writing, prior to construction. The construction contractor will designate a noise disturbance coordinator who will be responsible for responding to complaints regarding construction noise. The coordinator will determine the cause of the complaint and will ensure that reasonable measures are implemented to correct the problem. A contact telephone number for the noise disturbance coordinator will be conspicuously posted on construction site fences and will be included in the written notification of the construction schedule sent to nearby residents.

4.3.5 Summary Impacts of the Preferred Alternative

As described in Chapter 2, the preferred alternative consists of Restoration Alternative 2, Public Access Alternative B4~~3~~, Bridge Alternative BR4~~3~~, and fill disposal within the watershed. This section summarizes information from the individual impact sections previously described in Chapter 4: Environmental Consequences to provide an overview of the impacts of the preferred alternative as a whole.

Watershed Processes

Implementation would result in mostly beneficial impacts.

In terms of low flow hydrology, the project would not increase the frequency of drying of the Redwood Creek channel, and could provide benefits during the dry season due to perennial pools formed by the installation of LWD and increases in channel complexity. With respect to flooding, the proposed restoration and new bridge would lower flood levels somewhat, in addition to improving vehicle access along Pacific Way due to the bridge replacement.

Site soils would remain largely unaffected, and geohazards would be avoided through proper design and construction (e.g., to relevant seismic standards).

In terms of geomorphology, the relocation of the Redwood Creek Channel and construction of low berms along the side of the channel would reduce the potential for channel avulsion; improve Redwood Creek's ability to accommodate sediment loads and transport sediments to the Pacific Ocean; and maintain an equilibrium channel form. By being located further from the active channel, the new parking lot would also provide improved stream channel function and potential for geomorphic evolution.

The new bridge would improve the conveyance of flood flows and greatly improve channel stability, floodplain connectivity, and natural channel function. The fill disposal alternatives of the preferred alternative would have negligible effects on watershed processes.

Thus, the overall impacts of the preferred alternative would be beneficial and would restore and/or improve the natural watershed processes (hydrology, flooding, geology/soils/geohazards, and geomorphology).

Water Quality

Construction would have potential for short-term impacts related to erosion and sedimentation, as well as the release of hazardous materials. However, these impacts would be less than significant following implementation of mitigation measures. In the near term following construction, restoration could potentially affect turbidity, temperature, or nutrients in Redwood Creek as the new channel and site establish, but implementation of water quality monitoring and response plans would reduce these impacts to a less-than-significant level.

Over the long term, the restoration would result in beneficial impacts on the water quality of Redwood Creek as a result of increased water treatment functions associated with the backwater features and increased shade from riparian habitat. The new parking lot would also contribute to improving water quality by providing new swales that would provide treatment of non-point source runoff resulting from vehicles.

Water Supply

Restoration would reduce groundwater levels somewhat on the site, but would not affect the MSCSD well upstream. The public access, bridge and fill disposal actions would not have any effects on water supply, and none of the project components involve increased water use. Overall, the preferred alternative would not have any impacts to water supply.

Air Quality

Emissions of priority pollutants during construction would be less than significant with implementation of mitigation measures. Construction sequencing assumes that these features are not constructed simultaneously, and as such, they are not anticipated to combine to result in a larger impact.

Fill hauling and disposal was also determined be less than significant after mitigation to limit PM10 emissions. However, other construction activities would also have some PM10 emissions. Therefore, the combined PM10 emissions of fill hauling and disposal activities, along with the construction activities identified above, could create a significant, adverse air quality impact. Mitigation Measure AIR-MM-3 would require the project ensure that less than 80 ppd of PM10 is emitted from the project as a whole, and would effectively mitigate this impact to a less-than-significant level.

Following construction, the project would not contribute any air quality pollutants.

Vegetation Communities and Wetlands

The project as a whole would result in construction-related disturbance to vegetation. Over the long term, the project would result in a shifted mosaic of habitat types, from a system that includes equal portions of riparian and emergent wetland habitats, to one that is more focused on riparian habitat with a smaller proportion of emergent wetlands. While the preferred parking lot alternative (B4) would result in the short-term loss of slightly less than 1 acre of mature riparian habitat, at Year 50 vegetation communities at the site would experience improved floodplain functioning and an equal amount of new riparian vegetation as a result of the project.

The project components together are expected to result in no change or a slight decrease (about ~~0.15~~ 0.04 acres) of fill in jurisdictional waters of the United States. The removal of the levee road (0.33 acres), removal of the tavern remnants (0.01 acre~~s~~ gained) ~~slight~~ reduction in the size of the new picnic area compared to the existing picnic area (0.4 to 0.9 acre~~s~~ gained), ~~and~~ the ~~reconfigured~~ removal of much of the existing parking lot (0.73 acre gained), and the removal of Pacific Way Road (0.11 acre gained) will contribute a ~~small~~ moderate gain (up to ~~about 0.40~~ 1.43 acres) in wetland acreage. However, that gain, ~~but that~~ will be mostly offset by fill placed for a new pedestrian path (0.25 acre), ~~and~~ the bridge footings (0.007 acres), the reconfigured parking lot (0.93 acre), and road embankment (0.07 acre) for a total of 1.39 acres~~features (0.25 acres)~~. Due to the lack of specific designs, this Final EIS/EIR recognizes a possible loss of wetland acreage due to fill placement of less than 1 acre. Some jurisdictional acreage also may be lost due to possible natural conversion of wetlands near the beach to dunes. However, given the improved ecological function and value of the site resulting from all the features combined, the project would be beneficial overall to Waters of the United States.

Wildlife and Wildlife Habitat

Tree removal associated with construction could have short-term effects on cavity birds, bats, and common species of wildlife. However, these effects would be short term, and mitigation has been identified that would ensure that impacts are not significant overall.

Construction impacts to CRLF of the project would be minimal, since existing CRLF aquatic habitat would be left undisturbed, and additional areas of habitat would be constructed and would have new populations of CRLF introduced. CRLF habitat on the site would be expanded. Overall, the project would be beneficial to CRLF over the long term.

Fisheries

The overall impact of the preferred alternative's components would be beneficial on fisheries resources. The public access and fill disposal components would not affect fisheries at all.

Construction activities have the potential to adversely affect fisheries, immediately following or during construction activities from water quality impairments. However, implementation of the identified mitigation measures would reduce the significance of these potential adverse impacts.

The replacement bridge would result in a beneficial impact on fisheries by allowing for flood flows to spread out from the channel in a more natural manner thereby providing low flow refuge for fish along the flood margins.

The restoration actions would include many beneficial features for fisheries including: improve fish passage, reduce potential for fish entrapment, provision additional deep pool refuge, increased summer-rearing habitat, and increased areal extent and quality of winter-rearing habitat.

Cultural Resources

Several of the project components have potential to affect known or unknown cultural resources. However, mitigation has been identified that would reduce any such impacts to a level of insignificance. The preferred alternative would not result in a significant impact on cultural resources overall.

Recreation and Visitor Experience

Overall, the preferred alternative will have short-term adverse effects on recreational opportunities during construction, since site access will be restricted, and much of the site and the fill disposal sites will be in a disturbed state. In addition, there would be effects on visitor safety from construction activities and traffic, which would be mitigated to avoid significant impacts. The loss in recreational opportunities during construction will be offset to some degree by new recreational opportunities during construction, such as interpretation and volunteering.

Following completion of construction, the project is anticipated to represent a long-term benefit to visitors. This will be due to the more natural character of the site, as well as new amenities such as a two-way bridge on Pacific Way, a new pedestrian trail from Hwy 1 to the beach, and new interpretive facilities.

Traffic

Traffic-related impacts would primarily be limited to the construction period. There would be a reduction of available parking during construction activities, which would likely displace visitors to other park facilities along Hwy 1, with corresponding increases in traffic at those locations. Other construction-related effects on traffic relating to the implementation of include effects from: construction mobilization and materials deliveries, truck trips associated with fill disposal, fill disposal site preparation, and bridge construction. Although implementation of mitigation would reduce the significance of most of these impacts, the components of the preferred alternative would result in a significant, adverse impact on traffic during construction overall.

Over the long term, traffic conditions would be improved, with improved circulation due to the construction of the new Pacific Way Bridge. Parking availability would remain unchanged. Changes in intersection LOS would be minor, as would emergency response related to replacement of the levee road with the perimeter road for emergency access

Aesthetics

The various project components would all contribute to short-term degradation in scenic views and the existing visual character during construction activities. Nearby residences would have construction occurring adjacent to their homes, and the visual character of views from adjacent homes and businesses would be affected during construction times.

Over the long term, aesthetics at the site would be improved as a result of the restoration, and the rustic character of the site would be retained. The site would contain new features, such as a reconstructed parking lot, and a longer and higher Pacific Way Bridge, but these would only have minor adverse effects on aesthetics and would not overshadow the benefits of the project overall.

Energy, Public Services, Utilities, and Service Systems

The preferred alternative would result in energy and solid waste demands during construction. Construction would be designed not to interfere with emergency services, and mitigation has been identified to ensure that utilities and other service systems are uninterrupted. Over the long term, emergency access to the site would be improved through replacement of the existing one-lane bridge with a two-lane bridge.

Health & Safety

Construction activities could result in the risk of an accidental explosion or release of hazardous components during construction. Flammable fuels and other potentially hazardous substances would be required for the equipment used during construction. Excavation could result in exposure of people to undiscovered or undocumented sources of contamination. However, the preferred alternative's components would not collectively result in a significant impact because of mitigation measures to minimize the risk.

Following construction, there would be minor risk of exposure to hazardous substances from site maintenance activities. The risk of fire would be reduced due to the shift towards riparian forest, which is less fire-prone. The risk associated with mosquitoes would be reduced, because the amount of mosquito breeding habitat would be reduced compared to existing conditions.

Land Use, Planning, and Agriculture

The preferred alternative as a whole would be consistent with all relevant land use plans and policies, and would have minimal effects on agriculture.

Noise

Construction would generate significant noise impacts. Construction sequencing assumes that the various project components are not constructed simultaneously, and as such, they are not anticipated to combine to result in a larger impact. The exception to this would be fill hauling and disposal activities along Hwy 1 and at the fill disposal locations, which could occur simultaneously with the other project components. While these could combine to create a larger impact, they are anticipated to be distributed spatially, and so would not result in this outcome. For instance, noise-sensitive land uses near the fill disposal sites are far from the Big Lagoon site, and so would not be affected by construction noise at the Big Lagoon site itself.

The most substantial noise impact would be pile driving associated with the construction of the new bridge. Although mitigation has been identified to make most of the noise impacts of the project less than significant, this impact remains significant after mitigation. Pile driving would only occur for a very brief portion (up to several weeks) of the project.

Following construction, the newly restored site is not anticipated to result in any new noise.

Chapter 5

Other Statutory Considerations

This chapter discusses other impact analyses required by NEPA and CEQA. It includes discussions regarding the potential for cumulative impacts, growth-inducing impacts, irreversible and/or irretrievable commitments of resources, the relationship between short-term uses and long-term productivity of the environment, and significant and unavoidable impacts.

Cumulative Impacts

Methodology

Both CEQA and NEPA require the Final EIS/EIR to identify and analyze cumulative impacts. NEPA Section 1508.7 states that a cumulative impact can occur in a project area as a result of "individually minor but collectively significant actions taking place over a period of time." This impact can occur "when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions."

To meet the adequacy standard established by Section 15130 of the CEQA Guidelines, an analysis of cumulative impacts must contain the following elements.

- Analysis of related future projects or planned development that could affect resources in the project area similar to those affected by the proposed project.
- Summary of environmental effects expected to result from those projects, with specific reference to additional information stating where that information is available.
- Reasonable analysis of the combined (cumulative) impacts of the relevant projects.

The analysis of cumulative impacts must also evaluate the proposed project's potential to contribute to the significant cumulative impacts identified and discuss feasible options for mitigating or avoiding any contributions assessed as cumulatively considerable.

The discussion of cumulative impacts is not required to provide as much detail as the discussion of the project's *individual impacts*, or the effects attributable to the

project alone. Rather, the level of detail should be guided by what is practical and reasonable.

Lead agencies may use a “projection” approach or a “list” approach to identify related projects for the cumulative analysis, or both. The projection approach bases the identification of cumulative impacts on a summary of projections in an adopted general plan or related planning document (CEQA Guidelines Sec. 15130[b]). For this document, both approaches were used, as described below.

The analysis of cumulative impacts uses the same concepts of type, duration, timing, and intensity as described for individual impacts in Section 4.2 above.

Projections Used to Evaluate Cumulative Impacts

Marin Countywide Plan

The Marin Countywide Plan (Countywide Plan; adopted 1994) provides for the long-range direction and development of land within the County. The Countywide Plan is in the process of being updated; a draft of the updated plan was released in early 2004, with an updated draft released in mid 2005. The new plan is expected to be adopted in 2006 or 2007. Land use projections for the project area have not changed substantially since the 1994 Countywide Plan.

Comprehensive Transportation Management Plan

The CTMP is no longer planned for implementation; however, as part of the CTMP process, detailed traffic projections were developed for Hwy 1 in the vicinity of Muir Beach. These projections are used in this cumulative traffic analysis. The CTMP for Parklands in Southwestern Marin was a joint effort between Marin County, NPS California State Parks, Caltrans, other participating agencies, and the public in southern Marin to identify and evaluate the development of recreational travel model options to reduce traffic impacts of visitors on gateway communities and the parks. The CTMP was engaged in active planning during 2003 and 2004, but is no longer actively planning transportation projects. Heavy volumes of traffic and parking impacts on roadways leading to National Park areas in GGNRA and Mt. Tamalpais State Park resulted in a need to evaluate alternative access to the parks other than continued reliance on automobile. The CTMP project area included the parkland areas along Hwy 1 and Panoramic Highway, including Muir Woods National Monument, Mt. Tamalpais State Park, Muir Beach, Stinson Beach, Tennessee Valley, and the trails and other roads leading to these recreation attractions. The study area also included the developed area along Hwy 1 east of the parkland areas in Tamalpais Valley between the Manzanita park and ride and the intersection of Hwy 1 and Panoramic Highway. Finally, the study area included the identified locations of a possible transportation intercept facility (TIF) at Manzanita and at Rodeo Avenue.

List of Projects Potentially Contributing to Cumulative Impacts

Table 5-1 lists the projects that were considered in the evaluation of cumulative impacts. This list was developed based on input from NPS (Shoulders pers. comm.) and the Marin County January 2006 Semi-Annual Proposed Development Survey (PROPDEV-41) (Marin County 2006).

In reviewing PROPDEV-41, none of the County projects listed in the survey were found to be located in close enough proximity to the project site that they could contribute to cumulative impacts. The exception would be County projects in areas such as Tam Junction, Olema, and Point Reyes Station that could have minor traffic impacts along the Hwy 1 corridor; however, traffic projections developed for the CTMP, described above, are considered most representative of future traffic conditions in the project area, and were used in lieu of PROPDEV-41 for the analysis of cumulative traffic impacts. Other than these projects, the primary focus of this cumulative assessment has been on reasonably foreseeable future projects within the Redwood Creek watershed.

Table 5-1. List of Reasonably Foreseeable Future Projects

Project Name	Planning Jurisdiction	Project Characteristics	Schedule
Vegetation Stewardship	GGNRA	Management of non-native plants and trees within the GGNRA, including the Redwood Creek watershed. This has included the removal of eucalyptus trees and cape ivy along Redwood Creek.	Ongoing
Fire Management Plan	GGNRA	Various approaches to manage fire in GGNRA, including both mechanical fuels treatments and prescribed fire. Measures will be implemented to protect natural and cultural resource values.	ROD signed, 2006
Dias Ridge/Redwood Creek Trail realignment	GGNRA/CA State Parks	Realign trail from Panoramic Highway to route users to Muir Beach at Pacific Way.	EA released April 2007; Decision in Fall 2007; Construction planned 2008.~~Scoping completed; EA expected mid-2006~~
Floodplain and Salmonid Habitat Restoration on Lower Redwood Creek at the Banducci Site	GGNRA	Reconnect floodplain, enhance habitat in upper channel by using LWD and expanding the terraced floodplain, and reduce sediment transport downstream by expanding the available floodplain for deposition and by removing unstable channel banks in the upper channel. Create new ponds with emergent vegetation for future CRLF habitat.	Completed, 2007~~Planning underway; installation to occur in 2007~~

Project Name	Planning Jurisdiction	Project Characteristics	Schedule
Floodplain and Salmonid Habitat Restoration on Lower Redwood Creek at the Banducci Site	GGNRA	In the first project at this site, 1,800 linear feet of channel were reconnected with approximately 6 acres of historic floodplain by removing berms and installing log structures to enhance juvenile salmonid habitat in a formerly channelized reach. Allows sediment deposition in the floodplain.	Completed, 2003
Floodplain and Salmonid Habitat Restoration on Lower Redwood Creek at the Banducci Site	GGNRA, Marin County DPW	GGNRA and DPW would work together to raise 600 linear feet of Muir Woods Road at the intersection of Highway 1, thereby allowing berms to be removed along 900 linear feet of Redwood Creek and creating a new 8-acre floodplain for both salmonid habitat and flood storage	Not scheduled.
Negotiated Rulemaking for Dog Management	GGNRA	Dog management throughout GGNRA is being evaluated through an ongoing federally sanctioned Negotiated Rulemaking process and concurrent NPS environmental analysis. The outcome of these processes will determine how dogs will be managed on lands under NPS jurisdiction within the project area.	Scoping completed April 2006; Negotiated Rulemaking Committee concluded its work in October 2007; EIS in preparation.
Fern Creek Riparian Fencing	GGNRA	Installation of fencing and locally native plants to prevent human trampling of vegetation along Fern Creek, a tributary of Redwood Creek that supports coho and steelhead. A boardwalk was also installed along Redwood Creek where pavement was removed to limit visitors to trails and prevent impacts on redwoods in the riparian area.	1996
LWD Recruitment	GGNRA	Past practices of removing large woody debris from the Muir Woods' portion of Redwood Creek was discontinued in the 1990s. Large woody materials have been added into the creek in the late 1990s in the Muir Woods' portion of Redwood Creek to create pool habitat.	1990s
~~Road Restoration~~	~~GGNRA~~	~~NPS abandoned road restoration in Muir Woods to reduce sediment inputs.~~	~~Completed.~~
Southern Marin Equestrian Plan	GGNRA	Identify options for the future use of three Marin County stables located on GGNRA land, including site and facility needs/improvements, and protection of important resources at and surrounding the sites. Identify and enhance the public outreach and equestrian programs.	Scoping completed June 2006; EA in preparation.

Project Name	Planning Jurisdiction	Project Characteristics	Schedule
Muir Woods Road Decommissioning	GGNRA	Reduce sediment contribution to Redwood Creek by decommissioning 500 linear feet of an old road on a hillside at Muir Woods National Monument at a location where one landslide had occurred and a stream crossing was blown out. Prevented about 989 cubic yards of sediment delivery. Natural contours of the hillside were re-established, and the natural contour of an ephemeral drainage were recreated, with all infrastructure such as culverts and retaining walls removed.	Completed, 2003
Lower Redwood Creek Interim Flood Reduction Measures and Floodplain / Channel Restoration	GGNRA	Measures to reduce flooding on Pacific Way. Included excavation of sediment up- and downstream of Pacific Way Bridge; removal of woody debris and sediment between the Pacific Way Bridge and the NPS parking lot; removal of dead trees at risk of falling into the channel in the reaches described above; excavation of a 10 foot–wide pilot channel through the willow-alder grove downstream of the NPS parking lot and pedestrian bridge; installation of two armored dips in the levee road; removal of the flapgate on the more downstream culvert in the levee road; installation of willow mattresses at two floodplain channel inverts upstream of the Pacific Way Bridge; and excavation of a small trench at the low point on Pacific Way east of the Pacific Way Bridge.	Completed, 2002
2004 Interim Flood Reduction Measures	GGNRA	Excavated 300 Linear feet of channel near the Muir Beach parking lot when the channel was dry, and removed two log jams. Actions allowed the right fork channel to become the main channel again.	Completed, 2004
2005 Interim Flood Reduction Measures	GGNRA	Removed the lower end of picnic area to increase cross-section area available for high flows, and removed one log jam that was not in the low-flow channel.	Completed, 2005
Concession Contract at Muir Woods National Monument	GGNRA	Picnic lunches will be sold to the visitors at the Muir Woods National Monument. However, these lunches will not be consumed within the park. Picnickers will be directed to Muir Beach, Tennessee Valley, Muir Beach Overlook, or Stinson Beach to consume food purchased at the Muir Woods National Monument concession stand.	2007–2008
2006 Interim Flood Reduction Measures	Marin County DPW/SFZC	SFZC cut drainage channel south of Pacific Way through Green Gulch Pasture. DPW installed~~is installing~~ a culvert under Pacific Way.	Fall 2006

Project Name	Planning Jurisdiction	Project Characteristics	Schedule
Hwy 1 Intelligent Transportation System	GGRNA, Marin County, and Caltrans	The Intelligent Transportation System (ITS) notifies Hwy 1 motorists of traffic and parking conditions at south Marin recreational destinations. Consists of two portable electronic message signs on US 101. Messages also available by dialing 511. Operates between May and September. Not currently operated for Muir Beach but may be expanded.	Ongoing
Green Gulch Farm Residential Addition	Marin County	Construction of additional residential facilities.	2005
Green Gulch Farm Country Store	Marin County	Possible operation of a fruit stand or country store at the intersection of Hwy 1 and Pacific Way.	Not scheduled.
Green Gulch Farm Concrete Lining Removal	Marin County	Possible removal of concrete lining from Green Gulch tributary.	Not scheduled.
Muir Woods Road Fencing	Marin County	Fencing installed along Muir Woods Road to prevent roadside parking in some locations; intended to reduce sediment delivery from these locations.	Completed, March 2006
Muir Woods Shuttle Program	Marin County	Summer shuttle to Muir Woods National Monument from the Manzanita Park and Ride and Marin City on weekends and holidays. Pilot shuttle program is expected to operate in summer 2006 and summer 2007. Marin County is working with Caltrans and GGNRA to address several transportation issues in this area, one of which are the upgrade of Hwy 1 bus stops in Muir Beach, so they can be served by the shuttle.	Through 2007 and possibly beyond.
Kent Canyon Culvert Replacement	Marin County Department of Public Works	Installation of a new culvert connecting Kent Canyon and the mainstem of Redwood Creek to improve fish passage. Coho spawn upstream in Kent Canyon, but a culvert under the county-owned Muir Woods Road is sized and installed in a manner that impedes fish passage due to increased water velocities.	Completed, 2007.
Recontouring of West Peak of Mt. Tamalpais	MMWD	MMWD has assumed management of the West Peak of Mt. Tamalpais and may recontour existing airstrip.	Not scheduled
Vegetation Management and Trail Plans	MMWD	Trails and roads maintenance, erosion control, fuels management, and invasive species control in the Mt. Tamalpais watershed.	Ongoing
Deer Park Fire Road Regarding Project	Mt. Tamalpais State Park	Regraded the Deer Park Fire road to encourage improved run-off that would reduce sediment delivery downstream.	2004–2005
MBCSD Water Storage Tank	MBCSD	Possible construction of a new water storage tank to reduce the need for groundwater pumping during periods of low flow in Redwood Creek.	Not scheduled.
Pirates Cove Trail Realignment	GGNRA	Realign route of trail to reduce erosion and enhance native vegetation.	October 2006

Project Name	Planning Jurisdiction	Project Characteristics	Schedule
MBCSD Storage Shed Relocation	MBCSD	Relocate storage shed adjacent to Redwood Creek further from the creek.	2007–08
Public Transit Drop-off at Hwy 1 and Pacific Way	Marin County and Caltrans	Construct a disabled-accessible drop-off for shuttles and buses.	Not scheduled
Improve Pedestrian Crossing at Hwy 1 and Pacific Way	Marin County and Caltrans	No specific designs.	Not scheduled
Reconstruction of Camino del Canyon Road	National Park Service	Reconstruct road following damage after landslide in winter 2005.	July 2006
One-way Traffic on Muir Woods Road	Marin County DPW	Lane closures at two points on upper Muir Woods Road following landslide at edge of road in winter 2005.	Repaired
Repair of Upper Muir Woods Road	Marin County DPW	Repair of road and re-routing of drainage following landslide in winter 2005.	Fall 2006
Hamilton Wetland Restoration Project	U.S. Army Corps of Engineers and California Coastal Conservancy	Wetland restoration of between 900 and 2,300 acres near Novato	Ongoing
Sediment Reduction on Roads and Trails	MMWD	Road-related erosion control measures implemented at fourteen sites in the upper Redwood Creek Watershed, including Old Railroad Grade and Gravity Car Road, to prevent an estimated 5,100 cubic yards of sediment from entering Redwood Creek. Installed rolling dips, outsloped roads, replaced culverts with larger culverts, and installed an armoured crossing.	Completed.

Cumulative Impact Analysis

Watershed Processes

Implementation of the Big Lagoon project would not create any significant adverse watershed process-related cumulative impacts and would result in cumulatively beneficial impacts. Restoration Alternatives 2–4 would result in beneficial impacts including: reducing the potential for channel avulsion; improving Redwood Creek's ability to accommodate sediment loads and transport sediments to the Pacific Ocean; and maintaining an equilibrium channel form. In contrast, Restoration Alternative 1 would result in cumulatively adverse

impacts because no actions would be taken and the potential for channel avulsion, reduced sediment load transport, and maintenance of channel equilibrium would not occur. Other projects in the watershed (including the Salmonid Habitat Restoration on Lower Redwood Creek at the Banducci Site, the Floodplain and Salmonid Habitat Restoration on Redwood Creek at the Banducci Site, the MBCSD Water Storage Tank project, the Muir Woods Road Decommissioning, the Lower Redwood Creek Interim Flood Reduction Measures and Floodplain/Channel Restoration, and multiple Interim Flood Reduction Measures) would result in beneficial impacts on watershed processes. The potential beneficial impacts of Restoration Alternatives 2–4, in addition to the potential beneficial impacts of other projects in the watershed, would cumulatively restore and/or improve the natural watershed processes (hydrology, flooding, geology/soils/geohazards, and geomorphology) and would be a cumulatively beneficial impact.

All Public Access Alternatives of the project contribute to cumulatively beneficial flooding impacts in the watershed. The Bridge Alternatives would generally have negligible or beneficial impacts on flooding, except for Bridge Alternative BR1. Bridge Alternative BR1 would present an impediment to flows, which would be considered a significant and unavoidable adverse consequence of this Bridge Alternative. The Fill Disposal Alternatives are not anticipated to have effects on watershed processes.

Overall, the cumulative impact of the project with respect to Watershed Processes, considering other past, present and reasonably foreseeable future projects, is considered beneficial.

There is no watershed processes cumulative nexus between the project and other projects outside of the watershed.

Water Quality

Implementation of the project, including all action restoration, public access, bridge, and Fill Disposal Alternatives, would result in short-term adverse construction-related impacts on water quality. However, these impacts would be less than significant following implementation of the designated mitigation measures and would not contribute to a cumulatively significant adverse water quality impact.

Restoration Alternatives 2–4 would result in beneficial impacts to water quality over the lifetime of the project. These would help offset some known sources of impairment to the watershed, including elevated levels of nutrients and bacteria. In addition, the improved ability of the project to store/pass sediment to the ocean would provide benefits related to the cumulative conditions leading to excess sediment entering the system (e.g., development in the watershed, legacy of land uses).

Public Access Alternatives B1–B5 and C would also contribute to improving water quality by providing additional water quality treatment of non-point source runoff and/or reducing vehicle-related non-point source pollution. Bridge and Fill Disposal Alternatives would not result in any water quality impacts following construction.

Other projects in the project area that would benefit water quality include the Salmonid Habitat Restoration on Lower Redwood Creek at the Banducci Site, the Floodplain and Salmonid Habitat Restoration on Redwood Creek at the Banducci Site, the Muir Woods Road Decommissioning, the Lower Redwood Creek Interim Flood Reduction Measures and Floodplain/Channel Restoration, Deer Park Fire Road Project, Muir Woods Road Fencing, Vegetation Management and Trail Plans, Pirates Cove Trail Realignment, and Repair of Upper Muir Woods Road. These projects would benefit water quality by reducing erosion and sediment transport, restoring Redwood Creek to provide additional water quality treatment, and by restoring natural drainage patterns. The beneficial impacts of the project would be beneficial when considered with other projects in the watershed that also reduce sediment and nutrient transport and generally enhance the watershed's water quality.

There is no water quality cumulative nexus between the project and other projects outside of the watershed.

Water Supply

The project (all Restoration, Public Access, Bridge, and Fill Disposal Alternatives) would not result in any cumulative impacts on water supply. Restoration Alternatives 1–4 would have negligible impacts on groundwater levels at the MBCSD well or at Green Gulch Farm well. In addition, Public Access Alternatives B1–B5 and C, and all Fill Disposal Alternatives would not affect water supply quantities or water service to residents in the project area. The potential for disruption of water supply as a result of the need to relocate MSCSD water lines on the project site is discussed in Section 4.3.4.4, *Energy, Public Services, Utilities, and Service Systems*, under Impact PS-R4, and is mitigated to less than significant. None of the Bridge Alternatives would involve other activities that could affect water supply.

Other projects with potential to affect water supply include the Green Gulch Farm Residential Addition of five homes, which would generate some water demand. The potential MBCSD Water Storage Tank project would improve water supplies and reduce the need for groundwater pumping during dry periods by constructing a water storage tank. Therefore, cumulative impacts of the project and other projects in the area on water supplies would be less than significant.

Air Quality

The project would not result in significant cumulative air quality impacts. Restoration Alternative 1 would have negligible impacts on air quality because it would involve infrequent limited construction activities. Restoration Alternatives 2 and 3 would have less-than-significant impacts on air quality during construction activities with implementation of mitigation measures. Although Restoration Alternative 4 would also implement mitigation measures, the short-term air quality impacts of this alternative would be significant because the NO_X emissions would still exceed the significance threshold of 80 ppd. The Public Access Alternatives, Bridge Alternatives, and Fill Disposal Alternatives would have negligible or less-than-significant air quality impacts as a result of the construction and/or fill disposal activities, with implementation of mitigation measures.

Short-term air quality impacts could potentially result from construction activities related to most of the listed reasonably foreseeable future projects. However, it is expected that those projects would implement mitigation measures to reduce impacts and that construction activities for the projects would not all occur at the same time as evident by the listed schedule dates. In addition, some projects would protect or improve the long-term air quality by reducing fire fuels and/or by reducing the number of vehicle trips through the implementation of a shuttle program. These beneficial projects would be the Fire Management Plan and the Muir Woods Shuttle Program.

Emissions of air quality pollutants during construction of the project, in addition to pollutant emissions from other projects, would contribute to a short-term significant cumulative adverse air quality impact. Following the construction activities, the project would not contribute any air quality pollutants. This impact is considered a less-than-significant cumulative adverse impact.

Vegetation Communities and Wetlands

Cumulative impacts of the project would generally be beneficial. Some portions of the native vegetation communities in the project area would be disrupted or removed during construction of the project's Restoration Alternatives. Because it is likely that the construction of other projects could also remove native vegetation, the project's short-term impacts on vegetation communities would be cumulatively adverse. Emergent wetland communities would be adversely affected by Restoration Alternatives 2–4 and could be cumulatively adversely affected. However, Restoration Alternatives 2–4 would provide significant beneficial impacts, particularly in the long-term, on the extent and quality of riparian wetland habitat, open water habitat, dune habitat, decreases in noxious weed populations, the extent and quality of Corps-jurisdictional wetlands and other waters, and habitat changes for special-status plant species.

Bridge Alternatives BR1–BR4 would have small impacts on the extent and quality of riparian habitat. Public Access Alternatives B1–B5 and C would generally have either slightly beneficial or slightly adverse impacts on the extent and quality of riparian habitat. Fill Disposal Alternatives would generally have less-than-significant impacts on vegetation communities during construction and noxious weed populations through implementation of mitigation measures.

Other projects near the project area that could contribute to a cumulative beneficial impact would include the following projects: Vegetation Stewardship, Fire Management Plan, Negotiated Rulemaking for Dog Management, Salmonid Habitat Restoration on Lower Redwood Creek at the Banducci Site, Vegetation Management and Trail Plans, Pirates Cove Trail Realignment, and Hamilton Wetland Restoration Project. These other projects would beneficially impact vegetation communities by reducing human and pet impacts on native vegetation, restoring emergent vegetation, and managing nonnative plants. While the project could have short-term adverse effects, these are not considered cumulative due to their short duration. The overall benefits of the project, when considered with the potential benefits of the other projects, result in a determination of a beneficial impact on vegetation communities and wetlands.

Wildlife and Wildlife Habitat

The project's Restoration Alternatives could have cumulatively effects on wildlife and wildlife habitat, specifically regarding CRLF. Habitat fragmentation, increased predation of CRLF by fish, and construction activities could affect the population of the CRLF. Restoration Alternative 2 would have numerous benefits, as well as some adverse effects, and overall is anticipated to have negligible impacts on CRLF. However, the remaining three Restoration Alternatives would have significant, adverse impacts on CRLF. All of the Restoration Alternatives would have negligible or less-than-significant impacts on other wildlife species or their habitat.

The Public Access and Bridge Alternatives would all have negligible or less than significant impacts on other wildlife species. Fill Disposal Alternatives Unused Reservoir Pit, Upper Banducci Field, and Coastal Trail would have less-than-significant impacts on nesting birds from the vegetation cutting and removal actions.

Other projects that would or may benefit CRLF include: Green Gulch Farm's possible removal of concrete lining from Green Gulch tributary, Vegetation Stewardship, and Salmonid Habitat Restoration on Lower Redwood Creek at the Banducci Site. These projects would benefit CRLF by constructing new ponds with emergent vegetation for future CRLF habitat, restoring natural stream conditions, and by removing invasive plant species.

Although impacts on local CRLF and their habitat in the project area would be mitigated to minimize potential impacts and impacts of other projects in the area would be beneficial, any additional impacts on this species that is federally

threatened and a state-listed special status species of concern would be considered cumulatively, adversely significant**.** Overall, Restoration Alternative 2 and the various Public Access, Bridge and Fill Disposal Alternatives would not contribute to a cumulative impact on CRLF; Restoration Alternatives 3 and 4, however, would have a cumulative adverse effect on CRLF.

Fisheries

Fisheries would experience cumulatively beneficial impacts as a result of the project, specifically the Restoration Alternatives 2–4. While construction activities would have the potential to adversely affect fisheries immediately during or following construction activities, these would be short term. Implementation of the defined mitigation measures would reduce the significance of these potential adverse impacts and minimize potentially significant cumulative impacts. In addition, the Restoration Alternatives 2–4 would have many beneficial impacts on fisheries including: improved fish passage, reduced potential for fish entrapment, provision of additional deep pool refuge, increased summer-rearing habitat, and increased winter rearing habitat. The Public Access Alternatives would not be expected to affect fisheries, except potentially during construction when impacts would be less than significant. Bridge Alternatives BR1 and BR2, both with a 50-foot span, would have impacts on fisheries by increasing flow velocity under the bridge, and potentially affecting fish. Bridge Alternatives BR3 and BR4 would allow for flood flows to spread out from the channel in a more natural manner, providing low flow refuge in the flood margins. The Fill Disposal Alternatives would not affect fisheries.

Fisheries have benefited or would also be benefited from numerous other past and proposed projects that include: Salmonid Habitat Restoration on Lower Redwood Creek at the Banducci Site, Floodplain and Salmonid Habitat Restoration on Redwood Creek at the Banducci Site, Green Gulch Farm's removal of concrete lining from tributary, Lower Redwood Creek Interim Flood Reduction Measures and Floodplain/Channel Restoration, the MBCSD Water Storage Tank, Kent Canyon Culvert Replacement, Deer Park Fire Road Project, and Pirates Cove Trail Realignment. These projects would improve water quality by reducing sediment inputs, prevent the trampling of vegetation, remove invasive riparian plants, improve fish passage, create pool habitat, and removed artificial bank protection. The 2003 and 2007 projects on Redwood Creek at the Banducci site have direct benefits for salmonids by expanding and enhancing available winter and summer rearing habitat. Therefore, the beneficial impacts of the project, considered with the beneficial impacts of other local projects, would be cumulatively beneficial.

Cultural

None of the past, present, or reasonably foreseeable projects described in the list potentially are believed to contribute to degradation of the cultural resources at

the Big Lagoon site. This, in combination with the fact that the Big Lagoon project does not involve activities that would degrade cultural resources, results in the determination that there are no cumulative impacts with respect to Cultural Resources.

Recreation

Other projects would beneficially impact recreation by connecting trails, particularly the Dias Ridge trail, which would also then be connected to the Redwood Creek Trail and the Coast View Trail. The new trail through the site allows an easy connection from these trails to the Coastal Trail, as shown in Figure 5-1. In recontouring the Dias Ridge Trail and the Coast View Trail in more sustainable locations on hillsides, there will be a cumulative benefit in the visitor experience of trails that are more park-like and less like old ranch roads. In addition, other past and future projects near the project area could increasing the ability of the public to access local recreation sites by implementing a shuttle service, and by constructing a disabled-accessible drop-off for shuttles and buses. Concession contracts at Muir Woods National Monument could direct recreationists to consume purchased lunches at Muir Beach, thus increasing visitation and picnic area availability at Muir Beach. The Southern Marin Equestrian Plan will identify options for the future use of three Marin County stables, including the Golden Gate Dairy, including facility needs/improvements and identifying and enhancing public outreach and equestrian programs. That plan will address any potential cumulative recreational impacts on equestrian use.

Generally, the project would be cumulatively beneficial from the standpoint of recreation and visitor experience. The short-term adverse recreation-related impacts are not thought to be significant from a cumulative standpoint, because of the wealth of other recreational opportunities in the near vicinity. Public Access Alternatives that reduce the amount of available parking would have cumulatively significant recreational impacts by redirecting recreationists to other recreational outlets that also have capacity issues.

Traffic

Project construction could result in a variety of traffic impacts, both on site (related to parking capacity etc.) and off-site (fill hauling, equipment mobilization). Over the long term, local traffic flow will be improved by the Pacific Way Bridge. Public Access Alternatives may have an either beneficial or adverse effect, depending upon whether they change the capacity from that of the existing lot; reductions in parking would have adverse effects on regional intersections and roadways. Parking lot alternatives B1, B2 and C would contribute to cumulative adverse impacts by degrading level of service in areas where it is already severely degraded.

During construction, Restoration Alternatives 3 and 4 would contribute to cumulative adverse impacts by generating a large number of fill hauling trips along already congested roadways. The Hamilton Fill Disposal Alternative would share these impacts, since it would need to be used to accommodate the fill generated from these two alternatives.

Construction activities for other projects in the area could result in short-term traffic impacts; however, most impacts on traffic resulting from other projects in the area would be beneficial. The Hwy 1 Intelligent Transportation System, Public Transit Drop-off at Hwy 1 and Pacific Way, the Improve Pedestrian Crossing at Hwy 1 and Pacific Way, the Muir Woods Shuttle Program, and the reconstruction of Camino Del Canyon Road and Upper Muir Woods Road would have beneficial impacts on traffic. If the shuttle continues its link with ferry service from San Francisco to Sausalito, a public transit stop at Hwy 1, combined with the proposed ADA path to the beach, would allow recreationists from San Francisco to visit Muir Beach by ferry and bus, without the need for a personal vehicle. The Muir Woods Road Fencing, and a possible Green Gulch Farm fruit stand or country store project, along with possible future Hwy 1 construction due to landslides, could adversely affect traffic.

Because of their short duration, construction impacts are generally not considered cumulatively considerable. However, large amounts of fill hauling result in the determination that Restoration Alternatives 3 and 4 contribute to significant, adverse cumulative impacts. Public Access Alternatives B1, B2 and C, by reducing parking capacity and LOS, are also anticipated to lead to significant, adverse cumulative impacts. All other alternatives would have either no contribution or cumulatively beneficial effects on traffic.

Aesthetics

Construction of the Restoration, Public Access, Bridge, and Fill Disposal Alternatives would result in impacts related to alteration of scenic views and the existing visual character during construction activities. Nearby residences would have construction occurring adjacent to their homes, and the visual character of their homes would be affected during construction times. Visitors and recreationists to the project area would be subjected to construction-related activities, as would those traveling on Hwy 1.

Following construction, all of the various Restoration, Public Access, and Fill Disposal alternatives would contribute to a beneficial impact on aesthetics. Bridge Alternatives BR1–BR4 would change views on Pacific Way from implementation of the bridge, although not substantially, and would result in a less-than-significant impact.

Adverse impacts on aesthetics as a result of other projects would generally be related to construction activities and would be short-term. Implementation of any of the reasonably foreseeable future projects identified in Table 4.2.4.2-1 could result in short-term impacts on aesthetics. Long-term beneficial impacts on

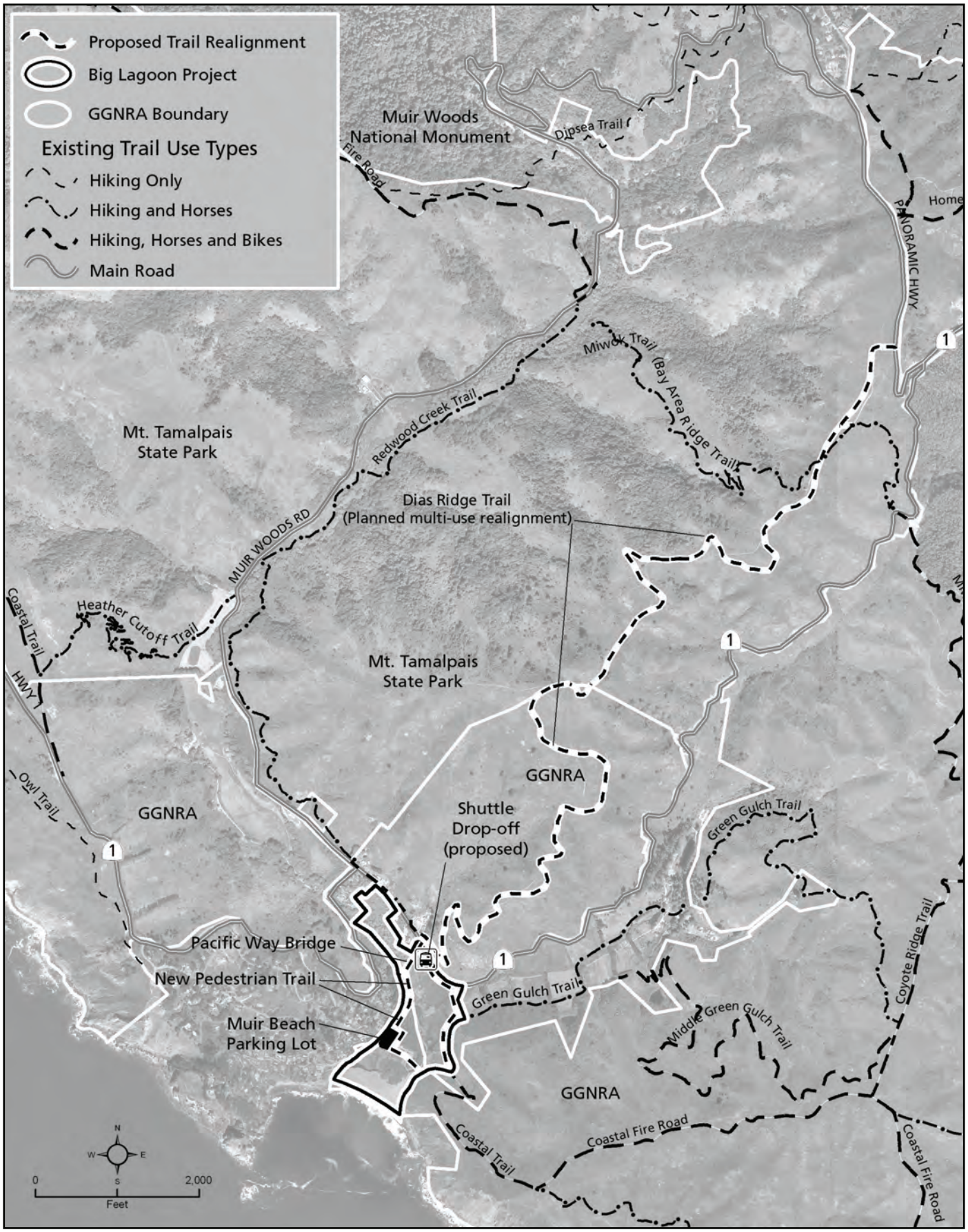


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Figure 5-1
Trail Connections (Proposed and Existing) in the Vicinity of Muir Beach

Exhibit 2: Final Environmental Impact Statement

aesthetics would likely result from the following projects' restoration activities: Salmonid Habitat Restoration on Lower Redwood Creek at the Banducci Site, Floodplain and Salmonid Habitat Restoration on Redwood Creek at the Banducci Site, Muir Woods Road Decommissioning, Lower Redwood Creek Interim Flood Reduction Measures and Floodplain/Channel Restoration, and Hamilton Wetland Restoration Project. While implementation of the project and other projects in the area would result in adverse impacts during construction, because they are distributed spatially and over time, are not thought to create a cumulative impact related to construction. Overall, the aesthetic effects of the project would be cumulatively beneficial.

Public Services

The project would not result in a significant cumulative impact on energy, public services, utilities, and service systems. Construction equipment will require energy during construction activities. However, the contractor would use gas-powered equipment and portable electricity generators, thus surrounding/regional energy users would not be affected by reduced energy supply. There would be no demand for energy or conflicts with existing energy use policies or standards after project construction. Public Access Alternatives B1, B2, and C would potentially result in increased congestion along Pacific Way and adjacent roads when parking demand exceeds supply or cause increased traffic on Hwy 1, which could both affect emergency response times. However, these impacts would be less than significant. All of the project's Fill Disposal Alternatives would result in negligible impacts on energy, public services, utilities, and service systems.

Other projects in the area would be unlikely to result in any significant impacts on energy, public services, utilities, and service systems. The Green Gulch Farm Residential Addition, and the Green Gulch Farm's possible operations of a fruit stand or country store could increase the demands on energy, public services, utilities, and service systems. Overall, the cumulative impacts of these other projects and the Big Lagoon project would be less than significant.

Human Health and Safety

Implementation of the project would not have cumulatively significant, adverse effects on human health and safety. The Restoration, Public Access, Bridge, and Fill Disposal Alternatives of the project would have negligible impacts, following implementation of mitigation measures, on the potential risk of an accidental explosion or release of hazardous substances during construction and the exposure of people to undiscovered or undocumented sources of contamination. The Bridge and Fill Disposal Alternatives would not result in any additional impacts. Restoration Alternatives 2–4 would reduce the potential for a fire hazard by reducing the area covered by annual grasses. Public Access Alternatives B1, B2 and B4 would reduce the number of spaces for motor vehicle use and thereby reduce the potential for fires caused by motor vehicles, where

dry vegetation is present. Other projects in the area that would beneficially affect human health and safety by reducing fire fuels are the Fire Management Plan, Vegetation Stewardship project, Muir Woods Road Fencing, and the Vegetation Management and Trail Plans. The project would not contribute to significant cumulative adverse impacts on human health and safety; therefore this impact would be less than significant.

Land Use, Planning, and Agriculture

The various project alternatives are consistent with existing land use plans and policies, and would have only minimal effects on agriculture through the reduction in area available for horse grazing. The project would therefore not contribute to any cumulative impacts related to loss of agricultural lands or unplanned development.

Noise

Construction activities for the project could result in noise impacts over 3–4 years of seasonal construction. Other reasonably foreseeable future projects could also result in short-term noise impacts. However, because constructions activities among these projects would be distributed spatially and over time, it is unlikely that they would be combine to create a cumulative noise impact.

Growth-Inducing Impacts

Implementation of the Big Lagoon project would not induce major or significant development or economic growth in the vicinity. Construction of the project would not generate a substantial number of new jobs that could cause economic growth in the area. The project would create an enhanced visitor experience (as described in Section 4.6, *Social Resources*) and, depending upon the Public Access Alternative that is selected, could improve public access by expanding the existing number of parking spaces or by creating a drop-off/turnaround zone. However, the preferred alternative does not include an expansion in the number of parking spaces or creation of a drop-off/turnaround zone. Other public access improvements would be expected to benefit visitors to the area; however, the improvements would not be expected to substantially increase the number of visitors to the project area (Section 4.6, *Social Resources*).

The project would improve year-round access for local residents from replacement of the Pacific Way Bridge, but would not stimulate development at Muir Beach. The unincorporated Muir Beach community lies within the West Marin Planning Area #7 and the Marin County Local Coastal Program Unit I. The Muir Beach Community Plan and the Marin County planning process, including the Marin County General Plan (adopted in 1994) and the Marin County Code, guide development at Muir Beach (Section 3.4.6, *Land Use*,

Planning, and Agricultural Resources). Title 13, *Roads and Bridges*, in the Marin County Code would guide the proposed bridge improvements. Therefore, the proposed bridge replacement would not stimulate unplanned growth and would be implemented in agreement with the project area's designated and planned land uses and zoning.

Socioeconomics

CEQ regulations implementing NEPA state that when economic or social effects and natural or physical environmental effects are interrelated, the EIS will discuss these effects on the human environment (40 CFR 1508.14). The CEQ regulations state that the "human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment." To the extent that the restoration project could affect the natural or physical environment, the socioeconomic analysis evaluates how elements of the human environment such as population, employment, and housing might be affected. Construction of the project would not generate a substantial number of new jobs or cause a change related to employment or housing demand.

Project construction may have minor effects on local businesses (e.g., the Pelican Inn, the San Francisco Zen Center) in that potential customers may be deterred by the construction activities and choose to plan their visit for another location. However, it anticipated that any effects would be short term, limited to the season of construction, and would cease once construction is complete. In addition, for the Pelican Inn, the project will have overall long-term benefits in terms of flood reduction, which helps enable their long-term economic viability. The Big Lagoon project is not anticipated to result in reduced viability of local businesses to the extent that they might fail, and as such has only minor impacts.

Sustainability and Long-Term Management

The first discussion below describes the trade-off between long-term sustainability and the short-term effects of the project. The second discussion addresses any irreversible (permanent loss or non-renewable resource) or irretrievable (short-term loss or loss of renewable resource) commitments of resources the project would require. The final discussion is a summary of any significant adverse impacts that cannot be mitigated to the level of insignificance.

Relationship between Short-Term Uses and Long-Term Productivity

Short-term uses of the environment that would occur with the project include the impacts on existing habitats associated with project construction. Short-term impacts would include the potential temporary disturbance of vegetation communities and various species of wildlife. In addition, potential releases of construction-related hazardous materials or sediment from access roads, staging areas, ground-disturbing activities and stockpiles could affect the existing water quality and fish species. Other potential short-term impacts resulting from construction activities include:

- temporary air quality impacts related to dust;
- reduced recreation opportunities;
- altered visitor perception and use of the project area;
- traffic impacts of delivery of construction equipment and fill disposal;
- alteration of scenic views and existing visual character; and
- elevated levels of noise.

The proposed project would create numerous long-term benefits to the existing site conditions and ecological function and the quality of the visitor experience. These include a variety of beneficial effects. Under all action alternatives, excavation of emergent wetland at the landward edge of the tidal lagoon would result in enlargement of the lagoon and enhanced dynamic quality from year to year and season to season. Installation of large woody debris adjacent to the tidal lagoon would increase the diversity of estuarine habitat in this area. In addition, relocation of the Redwood Creek channel to its historic back beach alignment would increase scour and tidal flushing of the tidal lagoon, resulting in improved water quality and habitat functioning. Native vegetation would be removed for this enlargement, but its loss would be offset by the gain in the dynamic quality of the lagoon and its function for salmonids.

Additional long-term benefits of the project would include, but are not limited to:

- developing a new pedestrian trail from Hwy 1 to the parking lot;
- providing new interpretive displays and trails; and
- implementing a higher bridge than the existing bridge to prevent flooding and preserve vehicular access during all but the largest of storm events.

The proposed project would be focused on promoting sustainability and long-term resource enhancement with minimal short-term resource damage or use. Construction phasing considerations (Chapter 2, *Alternatives*) and/or implementation of mitigation measures would reduce or eliminate the potential for most of the aforementioned short-term impacts. Site disturbance would be

minimized to the greatest extent possible by using existing disturbed areas for access roads and staging areas, and concentrating the area of disturbance associated with restoration actions to the minimum necessary based on the restoration design.

In summary, the project is designed to improve the long-term sustainability of the project site; however, as part of this effort, some short-term impacts are unavoidable.

Irreversible or Irretrievable Commitments of Resources

Construction materials, including gravel and other rock and earthen materials, would be irretrievably committed toward the construction of the new bridge and other components of the proposed project. Most of the construction materials would be reused from on-site sources (e.g., fill generated as part of project construction) or imported to the site from nearby commercial sources that have been subject to separate environmental review before they could make such materials available for use. The project would also involve use of energy, such as fuels for construction equipment. NPS employee time would be committed to the project, which would also constitute an irretrievable commitment of resources.

The restoration of the site is not considered an irreversible commitment of resources because the landscape could again be converted to other land uses in the future. The proposed project does not involve converting the land to urban land uses, which tend to be irreversible for all practical purposes.

Significant Unavoidable Impacts of All Alternatives

The various alternatives would result in 29 significant unavoidable environmental impacts. These impacts are summarized below. The preferred alternative (Restoration Alternative 2, Public Access Alternative ~~B3~~B4, and Bridge Alternative ~~BR3~~BR4) would result in only 9 of these significant unavoidable environmental impacts, of which all are construction related.

Restoration Alternatives

The No Action Alternative (Restoration Alternative 1) would have the following significant and unavoidable impacts:

- **WP-R5: Long-Term Flooding.** This alternative would continue to have flooding problems that would increase over time as elevated sediment delivery from the watershed increases channel aggradation and frequency of out-of-bank flows.

- **WP-R8 and WP-R9: Accommodation of Sediment Loads and Maintenance of Equilibrium Channel Form.** Because the channel would continue to aggrade, potential would increase over time for loss of defined channel form (e.g., through channel avulsion).
- **WP-R10: Potential for Channel Avulsion.** As described above, the potential for channel avulsion would increase over time as the channel aggrades.
- **FISH-R6: Fish Passage Barriers.** Channel avulsion could lead to the loss of a defined stream channel and inadequate conditions for fish passage.
- **FISH-R7: Fish Entrapment Due to Out-of-Bank Flows and/or Channel Avulsion.** During high-flow conditions, out-of-bank flows or channel avulsion could result in fish entrapment because fish may not be able to return to the stream channel once waters recede.

The action alternatives (Restoration Alternatives 2, 3, and 4) would have the following significant and unavoidable impacts:

- **VEG-R2: Construction-Related Impacts on Vegetation Communities.** During construction, disturbance to vegetation communities at the site would be unavoidable. This would be of greater extent for the more intensive alternatives (i.e., Restoration Alternatives 3 and 4).
- **REC-R1: Reduced Recreational Opportunities and Visual and Noise Disturbance During Construction.** Although efforts would be made to reduce impacts of restoration construction on recreation, some impacts would be unavoidable.
- **AES-R1: Alteration of Scenic Views and Existing Visual Character During Construction Activities.** Construction activities would have unavoidable adverse effects on views and character at the site, which would cease once construction was complete.
- **NZ-R1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Construction Activities.** Construction noise would be minimized to the extent possible but would still be considered a significant impact.

Restoration Alternatives 3 and 4 would also have the following significant and unavoidable impacts:

- **VEG-R4: Change in Extent and Quality of Emergent Wetland Habitat.** Under all of the action alternatives, there would be a possible substantial reduction of acreage of emergent wetland habitat, although the long-term mosaic of vegetation is difficult to predict and long-term changes in groundwater elevations could also reduce the loss of emergent wetlands. Although short-term potential losses would be partially replaced with a smaller extent of new higher-functioning wetland habitat, the overall potential loss is considered significant.

- **TC-R4: Effects of Truck Trips Associated with Fill Disposal.** Because of the number of haul trips that would be associated with excavation of the lagoons for these alternatives, impacts on traffic and roadways are considered significant and unavoidable.

Restoration Alternative 4 would also have the following significant and unavoidable impacts:

- **AIR-R1: Generation of Construction-Related Pollutant Emissions.** Construction activities would produce NO_x emissions that would exceed thresholds, thus resulting in a significant and unavoidable impact.
- **VEG-R5: Change in Extent and Quality of Riparian Wetland Habitat.** The loss of riparian extent and function in the first years after construction is considered a significant and unavoidable aspect of this alternative. However, as vegetation matures, functioning would be restored and a small increase in the areal extent of riparian habitat would occur.

Public Access Alternatives

The various public access action alternatives would have a variety of significant and unavoidable impacts, depending on alternative characteristic:

- **REC-P1: Reduced Resident and Visitor Access, Visitor Amenities, and Recreational Opportunities During Construction.** Reductions in available parking and other site amenities during construction of the Public Access Alternatives would have significant effects.
- **REC-P2: Effects of Parking Lot Configuration and Siting on Recreational Opportunities and Visitor Experience.** The two smallest lots, Public Access Alternatives B1 and C, would reduce visitor experience and recreational opportunities at the site because of insufficient parking.
- **REC-P5: Effects of Parking Lot Configuration and Siting On Community Relationships.** The reduced size of the parking lot under Public Access Alternatives B1 and B2 would increase potential for illegal visitor parking and conflicts with residents. Although Public Access Alternative C would also have reduced parking, its remote location would reduce these potential conflicts such that impacts were determined not to be significant.
- **TC-P1: Changes in Parking Availability During Construction.** Reductions in available parking during construction of the Public Access Alternatives would be considered significant from the standpoint of parking adequacy.
- **TC-P6: Long-Term Changes in Parking Availability.** The two smallest lots, Public Access Alternatives B1 and C, would have significant impacts from the standpoint of parking adequacy.

- **TC-P7: Effects of Parking Lot Size on Vehicle Queuing.** The two smallest lots, Public Access Alternatives B1 and C, would have significant impacts from the standpoint of vehicle queuing.
- **TC-P9: Long-Term Effects on Pedestrian, Equestrian, and Bicyclist Safety.** The location of Public Access Alternative C near Hwy 1, and length of the trail from the lot to the beach, would create some unavoidable impacts related to pedestrian, equestrian, and bicyclist safety.
- **TC-P12: Consistency with NPS Policies Related to Parking.** Public Access Alternatives B2 and C would have a shortage of parking capacity for some seasons. Thus these alternatives would be noncompliant with NPS policies.
- **AES-P1: Alteration of Scenic Views and Existing Visual Character During Construction Activities.** Construction activities would have unavoidable adverse effects on views and character at the site, which would cease once construction was complete.
- **LU-P1: Consistency with Land Use Policies Related to Trails.** Public Access Alternatives B1, B2, and C, by reducing parking lot capacity, would be inconsistent with County policies related to provision of adequate parking at trailheads.

Of these, the following would apply to the preferred alternative (Public Access Alternative ~~B3~~B4):

- **REC-P1: Reduced Resident and Visitor Access, Visitor Amenities, and Recreational Opportunities During Construction.**
- **TC-P1: Changes in Parking Availability During Construction.**
- **AES-P1: Alteration of Scenic Views and Existing Visual Character During Construction Activities.**

Bridge Alternatives

The No Action Alternative (Bridge Alternative BR0) would have the following significant and unavoidable impact:

- **PS-B4: Conflict with Emergence Response.** Existing parking constraints and restricted access during flooding events reduce emergency response time and access.

The action alternatives (Bridge Alternatives BR1, BR2, BR3 and BR4) would have the following significant and unavoidable impacts:

- **AES-B1: Alteration of Scenic Views and Existing Visual Character During Construction Activities.** Construction activities would have unavoidable adverse effects on views and character at the site, which would cease once construction is complete.

- **NZ-B2: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Pile Driving.** Despite the implementation of mitigation, the extreme level of noise generated by pile driving is considered a significant and unavoidable impact.

In addition, Bridge Alternative BR1 would also have the following significant and unavoidable impact:

- **WP-B1: Effects of Bridge Configuration on Flooding.** This bridge design would create a backwater effect and increase upstream flood elevations slightly, with potential to worsen flooding at the Pelican Inn and homes located in the floodplain upstream of Pacific Way.

Fill Disposal Alternatives

Disposal of fill at the Hamilton site would have the following significant and unavoidable impact:

- **TC-F2: Effects of Truck Trips Associated with Fill Hauling.** Because of the number of haul trips, the length of the haul route, and the degraded LOS on these roadways, impacts on traffic and roadways are considered significant and unavoidable. Note that this alternative would only be used in combination with Restoration Alternatives 3 and 4.

Significant Unavoidable Impacts of the Preferred Alternative

Of the 29 significant unavoidable environmental impacts described above for all alternatives, only 9 are associated with the preferred alternative (Restoration Alternative 2, Public Access Alternative ~~B3~~B4, and Bridge Alternative ~~BR3~~BR4). These impacts are:

- VEG-R2: Construction-Related Impacts on Vegetation Communities.
- REC-R1: Reduced Recreational Opportunities and Visual and Noise Disturbance During Construction.
- AES-R1: Alteration of Scenic Views and Existing Visual Character During Construction Activities.
- NZ-R1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Construction Activities.
- REC-P1: Reduced Resident and Visitor Access, Visitor Amenities, and Recreational Opportunities During Construction.
- TC-P1: Changes in Parking Availability During Construction.

- AES-P1: Alteration of Scenic Views and Existing Visual Character During Construction Activities.
- AES-B1: Alteration of Scenic Views and Existing Visual Character During Construction Activities.
- NZ-B2: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Pile Driving.

Chapter 6

Comments and Responses

Introduction

This chapter contains the written comments and oral testimony received on the Draft EIS/EIR, and NPS and the County's responses to each issue raised in the comments. Table 6-1 below identifies each comment letter and the page on which the comment letter and its responses begin. The chapter also contains Master Responses (MRs) that address several key topics in a comprehensive manner; they are presented before the comment letters.

Each comment letter has been assigned a letter, and comments within each letter are numbered consecutively (e.g., A-1, A-2, etc.) in the right margin adjacent to the individual comment. Each comment letter is followed by NPS and the County's response(s) to that letter. The responses are numbered to correspond with the comments as identified in the right margin of the letter. Where the response indicates that a change has been made to the EIS/EIR, revisions to the EIS/EIR are described briefly. The final EIS/EIR contains the revised text; text that has been deleted is shown in ~~strikeout~~, and text that has been inserted is <u>underlined</u>.

It should be noted that between circulation of the Draft EIS/EIR and publication of the Final EIS/EIR, the preferred Public Access and Bridge Alternatives have been changed from B3 to B4, and BR3 to BR4, respectively. These are minor technical changes that, pursuant to State CEQA Guidelines section 15088.5, "Recirculation of an EIR Prior to Certification," do not require recirculation of the Draft EIS/EIR.

Table 6-1. List of Commenters on the Draft EIS/EIR

Comment Letter Number	Commenter	Date of Letter	Beginning on Page
A	Federated Indians of Graton Rancheria	February 27, 2007	6-18
B	United States Environmental Protection Agency	February 28, 2007	6-20
C	California Coastal Commission	March 6, 2007	6-24
D	California Department of Fish and Game	February 28, 2007	6-33
E	Office of Historic Preservation	March 14, 2007	6-38
F	San Francisco Bay Regional Water Quality Control Board	March 6, 2007	6-41
G	California State Clearinghouse and Planning Unit	February 6, 2007	6-59
H	Marin Municipal Water District	December 29, 2006	6-62
I	Environmental Action Committee of West Marin	March 6, 2007	6-64
J	Greater Muir Beach Neighbors	February 15, 2007	6-68
K	Greater Muir Beach Neighbors	March 2, 2007	6-72
L	Green Gulch Farm Zen Center	March 5, 2007	6-76
M	Ocean Riders of Marin	March 5, 2007	6-81
N	Sierra Club Marin Group	March 5, 2007	6-87
O	Tomales Bay Association	March 6, 2007	6-99
P	C. Henry Barner	March 3, 2007	6-101
Q	Margaret Kettunen Zegart	January 28, 2007	6-103
R	Margaret Kettunen Zegart	February 26, 2007	6-114
S	Margaret Kettunen Zegart	March 6, 2007	6-118
T	David M. MacKenzie	March 6, 2007	6-120
U	John and Cela O. O'Connor	March 7, 2007	6-127
V	Walter Postle	January 5, 2007	6-131
W	Christian Riehl	March 6, 2007	6-135
X	Edward T. Sanford	January 8, 2007	6-139
Y	David Schonbrunn	March 6, 2007	6-141
Z	Planning Commission Public Hearing (various commenters)	February 26, 2007	6-147

Master Responses

Numerous comments were received on the topics of the preferred Bridge Alternative, salmonid rearing habitat, and sea level rise. Although each comment has been responded to individually, Master Responses also have been prepared to address each of these topics in a comprehensive manner.

MR-1 Preferred Bridge Alternative

Substantive comments on the preferred Bridge Alternative addressed concerns related to the bridge length, the width of the bridge, the aesthetic appearance, and the cost. NPS's responses to these concerns are addressed below.

Selection of New Preferred Bridge Alternative

After further consideration, Marin County has chosen to select Bridge Alternative BR4, as opposed to Bridge Alternative BR3, as its preferred alternative. The County recognizes that a longer bridge will provide the best vehicular access and opportunity for natural hydrologic processes to reestablish. Concerns about the appearance and cost of the bridge are also discussed below.

Revised Bridge Alternative BR4

Bridge Alternative BR4 has been modified to reflect as realistic a conceptual design as possible prior to the actual design phase. The revised Bridge Alternative BR4 is slightly reduced in length compared with the alternative described in the Draft EIS/EIR (250 feet vs. 266–300 feet). The revised length of the bridge represents a refined analysis of design constraints, including a more realistic connection to existing roads and driveways on either side of Redwood Creek. The 250-foot bridge will allow the existing bridge to remain functional during construction. The elevation of Pacific Way in front of the Pelican Inn entrance will be raised to approximately the same elevation as the Pelican Inn driveway. The hydraulic modeling conducted for the Draft EIS/EIR is still valid for these bridge parameters; conservative assumptions were used in the modeling that are not affected by this change. For the purposes of evaluating the modeling results, the redesigned Bridge Alternative BR4 is anticipated to perform somewhere in between Bridge Alternative BR3 and the longer Bridge Alternative BR4 (as modeled).

The height of the revised bridge will be determined during the design phase but is anticipated to be between the heights of Bridge Alternative BR3 (16.25 feet NGVD) and the original Bridge Alternative BR4 (18 feet NGVD). The elevation of Hwy 1 is 16.5 feet NGVD; therefore, the height of the bridge under Alternative BR3 would be 0.25 feet lower than Hwy 1, while the height of the bridge under Alternative BR4 would be 1.5 feet higher than Hwy 1. For

comparison, the height of the existing bridge is 15.2 feet NGVD, 1.3 feet lower than the elevation of Hwy 1. A height will be selected that accommodates the largest flows possible while also accommodating the new grade of Pacific Way from Hwy 1 and avoiding backwater effects that could increase flood elevations upstream. The new grade of Pacific Way from Hwy 1 to the bridge would tie into the elevation of the Pelican Inn parking lot. There may be other design elements that need to be addressed simultaneously with the design height. Thus, the height of the proposed bridge ultimately will be determined during the design phase, in consideration of the existing constraints presented by the entrance to the Pelican Inn parking lot and the need to avoid backwater effects.

In addition to modifications to the proposed length of the bridge, the maximum width of the bridge has been reduced. The County will reduce the maximum possible width from 36 to 32 feet, with the specific width to be determined during the design phase. The 32-foot width proposed in the new Bridge Alternative BR4, as with the 36-foot width previously discussed in the EIS/EIR, is intended as a maximum width for environmental review purposes and therefore should be viewed as conservative and could be reduced during final design. The proposed maximum width includes two vehicle lanes (each 10 to 11 feet wide), up to a 1-foot-wide shoulder on each side, and a 6-foot-wide pedestrian path. It may be possible to reduce the width below 32 feet during design, but future design plans must be prepared to confirm the feasibility of reducing the width below 32 feet.

Bridge Costs and Value Analysis

After further review of the Value Analysis and costs presented in the Draft EIS/EIR, NPS and the County have concluded that the bridge costs were underestimated in the document. Initial cost estimates for project alternatives were developed during the Value Analysis process to provide a preliminary comparison of costs between alternatives; however, these initial values did not consider certain factors, such as various aspects related to construction management and design contingencies. NPS and the County have recalculated the cost estimates for the proposed Bridge Alternatives to reflect realistic values that can be estimated at this early stage of project design. The Final EIS/EIR has been corrected to reflect the revised cost estimates (see Chapter 2, *Selection of the Preferred Alternative*).

As stated above, the longer Bridge Alternative (BR4) has been selected as the preferred Bridge Alternative. This Bridge Alternative also has been shortened and narrowed. Consequently, the revised cost estimate for this alternative is approximately $600,000 less than the long bridge configuration described in the Draft EIS/EIR. Regardless of the cost difference between the original and revised Bridge Alternatives, the longer Bridge Alternative will cost more to construct than the previous preferred Bridge Alternative (BR3). The County has selected the longer Bridge Alternative despite its higher cost because the improved benefits to long-term channel and floodplain functioning, which will in turn improve salmonid habitat, would meet the project objectives best. This alternative is also expected to require the least maintenance.

Bridge Aesthetics

Many comments expressed concerns that the bridge would not be compatible with the surrounding landscape and rustic visual character of the area. However, it is NPS's and the County's conclusion that the new bridge will not be incompatible with the local character. The bridge would appear as a long causeway, a continual flat or slightly rising connection from Hwy 1. As discussed above, the height of the bridge would be between the height of Bridge Alternative BR3 (16.25 feet NGVD) and BR4 (18 feet NGVD). The ultimate design of the bridge (Bridge Alternative BR4) would be somewhere between 0.25 below and 1.5 feet above the elevation of Hwy 1. The bridge would be simple; design details, particularly for the railings, would be tailored to fit in with the rural setting of the area.

Pedestrian Bridge

Many comments requested consideration of a second bridge to provide pedestrian and equestrian access to Muir Beach from Hwy 1. Although a separate bridge may be perceived as providing additional visitor protection against vehicles, NPS and the County believe that the costs of construction and the impact on Redwood Creek outweigh the benefits of a separate bridge. It would be substantially more expensive to construct a separate set of piers for a pedestrian bridge than to use the roadway bridge piers to support the pedestrian path. If a second pedestrian bridge were to be constructed, the combined footprint of the vehicle and pedestrian bridge could be wider than that proposed in the revised Bridge Alternative BR4 because of the accommodation of two sets of railings. Additional fill or bridge pilings would be required for the second bridge, all of which would further intrude on the Redwood Creek floodplain. The County and NPS will comply with appropriate disability access requirements and ensure that adequate safety measures are incorporated into the bridge design.

MR-2 Salmonid Rearing Habitat

One important project objective is to improve winter-spring rearing habitat for coho salmon and steelhead by increasing floodplain inundation frequency, the extent of winter-spring baseflow habitat, and floodplain connectivity. The preferred alternatives will improve the quality, and where possible increase the quantity, of these types of winter-spring rearing habitat compared to existing conditions.

Existing Conditions

Under existing conditions, coho salmon have been observed to use inundated portions of the project site as winter rearing habitat. Floodplain inundation of these areas is influenced by:

- frequent overbank flows upstream of the Pacific Way bridge because of (a) channel aggradation upstream of the bridge and (b) existing floodplain topography that drains away from the creek;
- large-scale ponding in Green Gulch pasture because of (a) the 1,300-foot-long levee road, which disconnects the floodplain from the main creek channel, and (b) the two culverts crossing the levee road that limit outflows from the pasture to the main channel;
- periodic out-of-bank flow in the mainstem of Redwood Creek (downstream of the Pacific Way bridge) because of local sedimentation; and
- extreme tidal conditions that delay channel drainage in the lower reach (near the parking lot).

The main channel currently has an average conveyance capacity of approximately 250 to 300 cfs between the upstream project limit and the parking lot. Therefore, overbank flooding occurs when flows exceed 250 to 300 cfs, which happens usually one or more times per year[1], except during unusually dry years[2]. However, there are also local areas of reduced conveyance (because of irregular sediment deposition, log jams, etc.) that cause more frequent out-of-bank flows. For example, there are at least two locations upstream of the Pacific Way bridge where the creek routinely spreads onto the floodplain at flows lower than 250 cfs (see Figure 6-1).

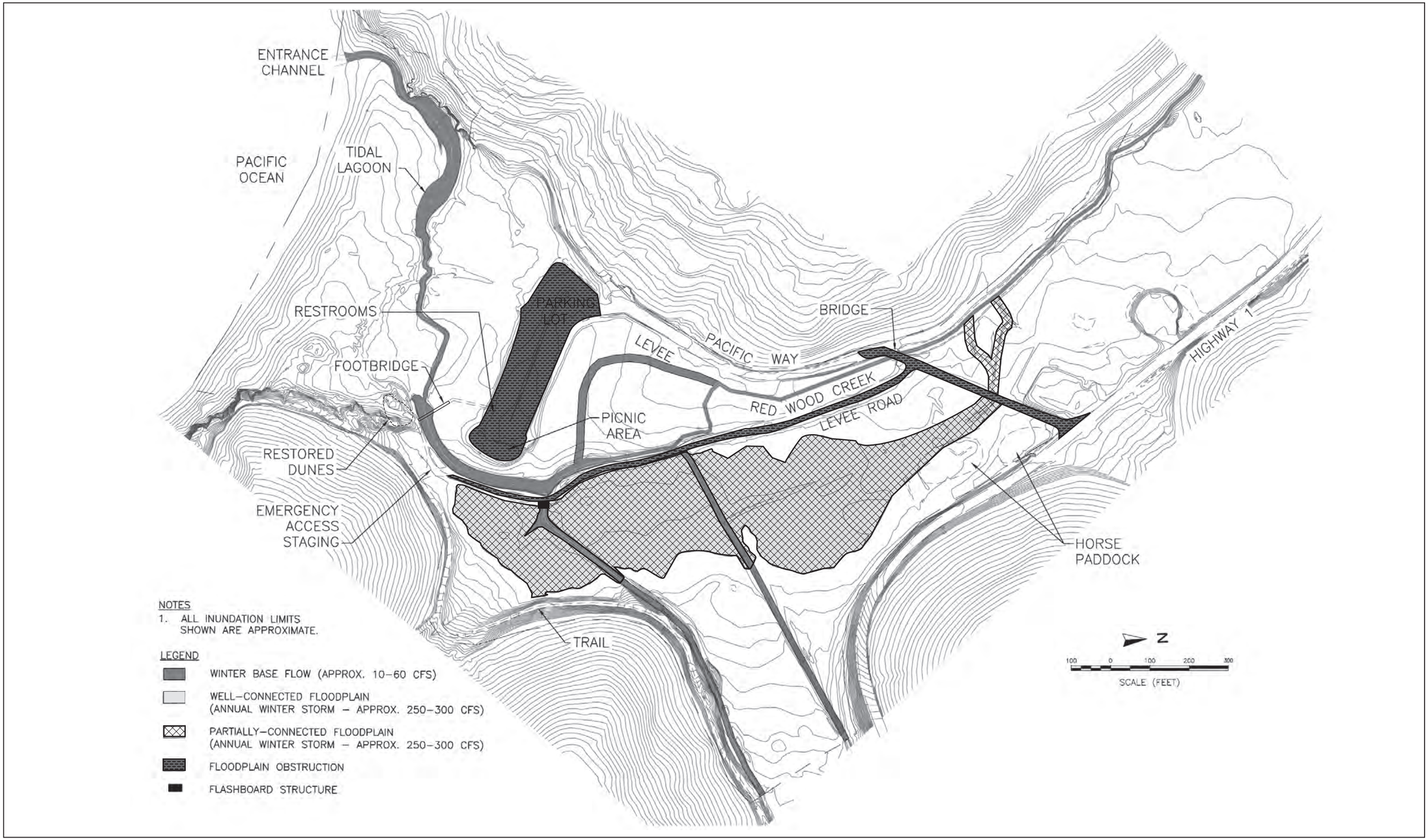
Sediment accumulation upstream of the Pacific Way bridge results in relatively frequent out-of-bank flows (e.g., several times each winter). Once out-of-bank, creek flows follow the natural gradient away from the channel, across Pacific Way (at its low point near Pelican Inn) and through Green Gulch pasture. Flow out of Green Gulch pasture is limited by two culverts through the levee road that include flashboard structures intended to pond water year-round at an elevation of approximately 8 feet NGVD. Therefore, the floodplain area in Green Gulch pasture has two potential fish passage barriers, the 500-foot Pacific Way road to the northwest and the 1300-foot levee road (with flashboard structures) along the west boundary.

Figure 6-1 is a qualitative representation of likely inundation areas usable as winter rearing habitat under existing conditions. The dark grey areas represent open-water areas (the active channel and backwater areas) under typical winter base flow conditions (approximately 10 to 60 cfs). The cross-hatched areas approximate flooded areas during larger winter storms (approximately 250 to 300 cfs) that would normally occur at least once a year[3]. These floodplain areas

[1] Redwood Creek flows exceeded 300 cfs an average of seven times per year during the 7 years of complete continuous flow records between 1998 and 2006. Data used to calculate this average value include 2002, when there were no flows greater than 300 cfs.

[2] In the 28 years of record for Redwood Creek between 1972 and 2003, peak flows exceeded 300 cfs 86% of the time (in all but 4 years).

[3] Approximate flooding extent based on ponding up to an elevation of 9 feet NGVD in Green Gulch pasture, or 1 foot above the flashboard structure control (elevation 8 feet NGVD).



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Jones & Stokes

Figure 6-1
Winter Salmonid Rearing Habitat Under Existing Conditions

Exhibit 2: Final Environmental Impact Statement

contained by a berm. This design feature would reduce risk of fish stranding and subsequent predation on frog tadpoles.

- Abandoned remnants of the existing channel will be connected to the realigned creek (and deepened if needed) to serve as backwater channels. In addition, the existing backwater channel (parallel to levee road) and the tidal lagoon will be expanded to create additional backwaters. This will significantly increase the length of backwater channels compared with existing conditions, and provide additional rearing habitat during winter baseflow conditions.
- The levee road and associated water control structures will be removed. This will reduce the frequency and duration of ponding in Green Gulch pasture but will significantly improve channel-floodplain connectivity and allow unrestricted fish passage between the pasture and Redwood Creek.
- Tidal conditions will remain unchanged from existing conditions; extreme tidal conditions are expected to continue to delay channel drainage in the lower reach.

Figure 6-2 is a qualitative representation of likely inundation areas usable as winter rearing habitat under the preferred alternative. Similar to Figure 6-1, dark grey shows inundation during winter base flow (10 to 60 cfs). Fully connected floodplain areas (shown in light grey) are expected to include low-lying areas in the Green Gulch pasture and the wooded floodplain adjacent to the parking lot. The crosshatched area southeast of the parking lot (labeled *potential connected floodplain*) is anticipated to be partially or wholly inundated during annual winter storms, but the degree of inundation and floodplain connectivity would depend on the grading design for this area, which has yet to be determined.

Comparison of Existing Conditions and the Preferred Alternative

The approximate areal extent of winter rearing habitat under existing conditions and the Preferred Alternative (as shown in Figures 6-1 and 6-2) is summarized below in Table 6-2.

are partially disconnected from the main channel by existing obstructions of the levee road and Pacific Way (shown in dark grey with black dashes).

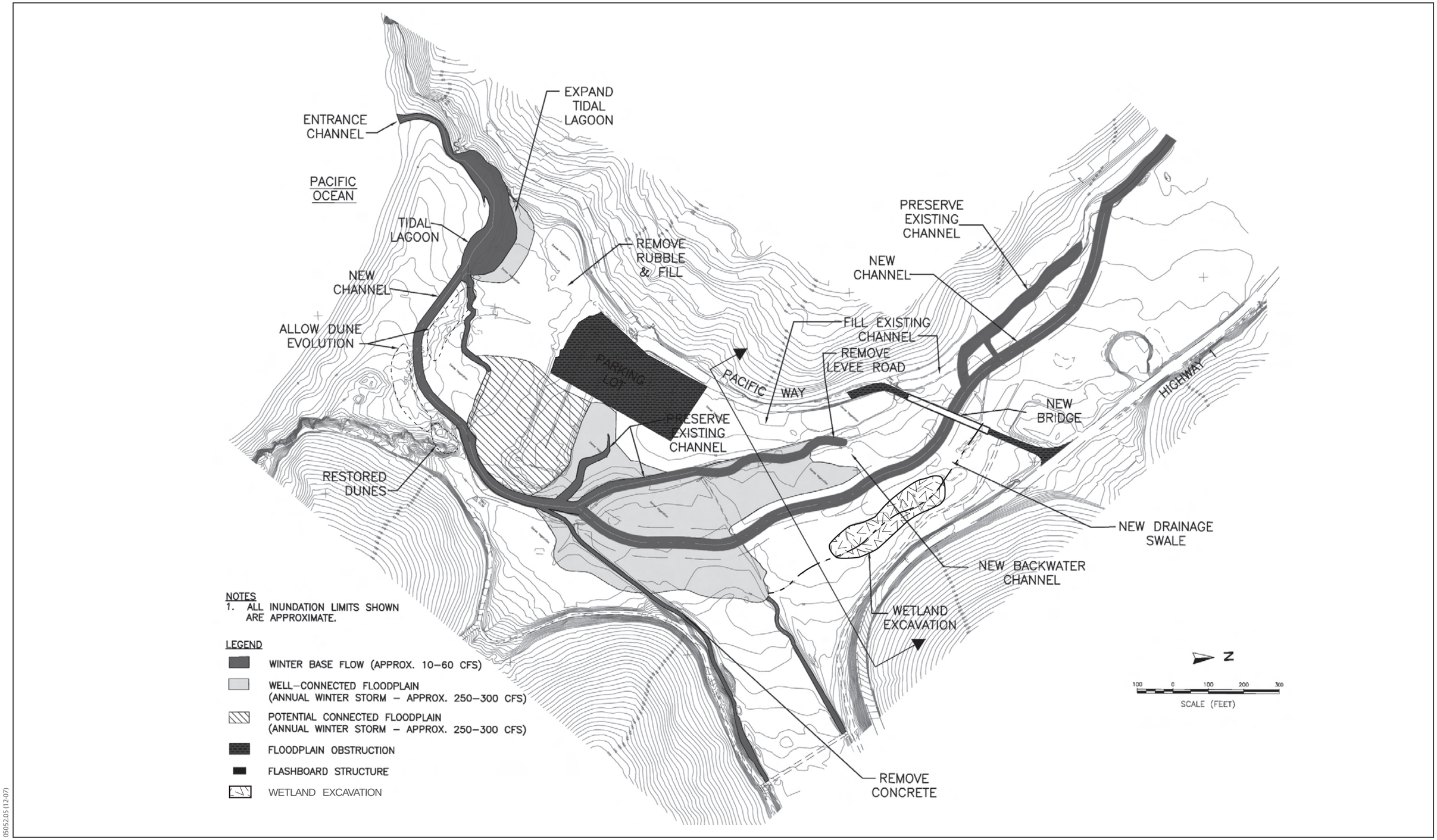
Conditions under the Preferred Alternative

The preferred alternative (Restoration Alternative 2, Public Access Alternative B4, Bridge Alternative BR4) includes the following actions that will improve winter-spring rearing habitat conditions by increasing extent and quality of baseflow habitat, functional floodplain areas, and channel-floodplain connectivity.

- Upstream of the bridge, the creek will be realigned to the lowest point in the floodplain. The new channel will be sized for the estimated typical fluvial conditions (approximately 560 to 800 cfs), which is larger than existing conditions (average of approximately 250 to 300 cfs). Therefore, less frequent out-of-bank flow is expected compared to existing conditions. However, the channel realignment will allow overbank flows to return directly to the channel, thus improving channel-floodplain connectivity. In addition, the existing channel will be preserved as a backwater channel, which provides additional rearing habitat during winter baseflow conditions.
- The existing 25-foot Pacific Way bridge will be replaced with an approximately 250-foot bridge that spans the floodplain. This change will also improve floodplain connectivity and benefit water quality.
- Downstream of the bridge, the creek will be restored to its original alignment along the low point of the valley through Green Gulch pasture. The upper 800 feet of proposed channel will have roughly the same flow capacity as the existing channel,[4] approximately 250 to 300 cfs. The lower 400-foot reach (from Green Gulch Creek to levee road) will have reduced capacity[5] (by the absence of berms in this reach) to further increase the frequency of overbank flooding.
- Large woody materials would be added into the backwater and main channel habitats to provide cover for aquatic life as well as to provide conditions that would help maintain deep pools. The need for maintenance dredging and the resulting channel and habitat impacts are expected to be significantly reduced.
- Existing land excavated in low-lying areas in Green Gulch pasture and the wooded floodplain are expected to be inundated during large winter storms (at 250 to 300 cfs) where creek flows are not contained by channel berms. One of two depressional areas created as California red-legged frog habitat will be located in the Green Gulch pasture area where the creek will be

[4] Channel dimensions will be roughly the same as the upstream reach, but conveyance will be reduced because of decreased channel slope (because of natural gradient and meandering) and increased roughness (because of introduced large woody debris, etc.).

[5] The new channel will be constructed by excavating to the thalweg depth and building up the banks using low berms. Discontinuing the channel berms in the downstream 400-foot reach of the creek will effectively reduce the channel depth by roughly 1 foot and reduce channel conveyance to approximately 150 to 200 cfs.



05052.05 (12-07)

Jones & Stokes

Figure 6-2
Winter Salmonid Rearing Habitat Under the Preferred Alternatives

Exhibit 2: Final Environmental Impact Statement

Table 6-2. Approximate Aerial Extent of Winter Rearing Habitat

	Approximate Areal Extent (acres)	
Description	**Existing Conditions**	**Proposed Conditions**
Main Channel (winter base flow)	3.0	3.0
Backwater Areas (winter base flow)	0.2	1.6
Partially Connected Floodplain (annual storm)	6.7	
Fully Connected Floodplain (annual storm)		5.1
Potential Connected Floodplain (annual storm)		up to 2.1*
Total Inundated Area	9.9	9.7 to 11.8*

*Note: The potential connected floodplain near the existing parking lot has not been included in hydraulic analyses to date, but grading designs could create elevations in this area to allow overbank flow over an additional 2.1 acres in an annual storm event, thereby extending the connected floodplain by approximately 11.8 acres.

As shown in Table 6-2 above, the total areal extent of winter rearing habitat for backwaters and floodplain combined is roughly the same for existing and proposed conditions, and the preferred alternative has opportunities to expand the areal extent of annual floodplain by up to an additional 2.1 acres. Based on topographic data currently in this project's hydraulic model, the total areal extent of overbank flooding during an annual storm would be approximately 1.6 acres or 25% less for the proposed condition compared to the existing condition. However, the model does not incorporate the opportunity to lower the grade of the existing parking lot and picnic area to allow annual storm overbank flow in those areas. Since the parking lot and picnic area will be graded as part of project actions, it is possible to grade them to achieve the desired expansion of floodplain during an annual storm event. Therefore, up to an additional 2.1 acres of "potential" connected floodplain habitat (or a 30% increase in area) is shown on Figure 6-2, although the exact area would be determined during the project design phase. Because a grading design for this area has not been developed or included in the hydraulic analysis or earthwork estimates of the preferred alternative, Table 6-2 shows this area as "potential connected floodplain" and the high end of a range of the total inundated area.

In addition to the potential increase in area, both the floodplain quality and function will be improved by removal of floodplain obstructions. The preferred alternative is expected to increase floodplain connectivity, fish passage, and extent of backwater channel habitat compared with existing conditions. During annual winter storms, fish using the floodplain will be more likely to find their way back to the channel than under the existing conditions.

The various factors affecting winter rearing habitat under existing conditions and the Preferred Alternative are discussed in more detail below.

Winter-Spring Baseflow Habitat (Main and Backwater Channel Habitats)

It is expected that the Preferred Alternative will increase the extent and quality of winter-spring baseflow habitat for fish compared to existing conditions. Research previously cited in Chapter 4 indicates that ideal winter-spring rearing habitat for juvenile coho would be deep, slow-water, main channel pools linked with adjacent off-channel habitats that provide high flow refuge (Bell 2001). Design elements for this project seek to provide both good winter baseflow habitats and adjacent off-channel refuge.

Under the Preferred Alternative, the existing backwater channel will be extended by approximately 400 feet and the tidal lagoon will be expanded. In addition, remnant portions of the existing main channel (approximately 700 to 1,000 linear feet) will be preserved (and deepened if needed) to function as additional backwater areas. These backwater sloughs are expected to provide habitat that is well shaded by the surrounding mature riparian vegetation. The proposed project will increase total backwater areas from approximately 0.2 to 1.6 total acres.

Floodplain Inundation

The Preferred Alternative is expected to increase the amount of well-connected floodplain by removing the existing floodplain obstructions that isolate the 11-acre Green Gulch pasture from the main creek system. During an annual storm event, approximately 5.1 acres of the project area will experience shallow flooding. Although a somewhat larger area (6.7 acres) currently experiences annual flooding, this floodplain has lower habitat value because it is disconnected from the main channel by existing roads and the flashboard structures, increasing the potential for fish stranding as flows recede. The floodplain area during an annual storm event could be increased by about 2.1 acres through grading designs of the parking lot and picnic area removal area, as described above, thereby both increasing the areal extent and the quality of floodplain during annual events.

Upstream of Pacific Way bridge, the 8-acre floodplain area will experience reduced flooding frequency under proposed conditions, because of replacement of the existing undersized bridge, which causes severe sedimentation. However, similar to Green Gulch pasture downstream, the floodplain function will be improved by realigning the channel to the valley low point and replacing the at-grade Pacific Way road with the floodplain-spanning bridge. These two changes will improve channel-floodplain connectivity and reduce the risk of fish stranding on the floodplain.

It should be noted that the extent of floodplain inundation for a 2-year storm (800 cfs) is approximately the same for the proposed and existing conditions. Almost the entire project area is expected to be inundated during a 2-year event, except topographic high areas, including portions of Pacific Way, the parking lot, and the bluffs on either side of the beach.

It is expected that the duration of floodplain inundation of the preferred alternative would be less than under existing conditions. However, as noted

previously, the duration of inundation under existing conditions is maintained by artificial conditions of a levee and culvert system.

Floodplain Connectivity

Under existing conditions, there are several barriers to floodplain connectivity.

- Upstream of the Pacific Way bridge, the channel is partially disconnected from the floodplain because of existing topography (i.e., the floodplain drains away from the channel).
- Pacific Way bisects the floodplain on either side of the road.
- The levee road disconnects the existing floodplain from the Green Gulch pasture.
- The southeastern end of the parking lot partially blocks the floodplain.

All of these obstructions will be removed under the proposed project, which will increase the area of connected floodplain habitat. The most significant change under proposed conditions is that Green Gulch pasture, including its tributaries, will be connected to the mainstem of Redwood Creek without any fish passage barriers.

Reduced Maintenance Dredging

By raising Pacific Way and removing hydraulic impediments (e.g., the south end of parking lot and the levee road), the need for maintenance dredging, with its associated fish population impacts, are expected to be significantly reduced under the proposed project.

Floodplain Activation Flows

In 2006, PWA completed a study for UC Davis and CALFED that correlated floodplain flows in the lower Sacramento Valley with beneficial fish rearing conditions (PWA 2006). This PWA study on floodplain activation flows (FAF) identified timing, frequency, and duration as key criteria to apply to evaluate ecosystem benefits attributable to floodplain inundation. These benefits were based on research that links multiple ecosystem processes, including phytoplankton production in the water column and fish rearing on the floodplain. These benefits are expected to increase proportionally to the area flooded.

The hydrologic and landscape characteristics of the large-scale lowland river system from which the FAF is derived are different from the Big Lagoon site. However, a similar approach of defining the hydrologic regime of activated floodplain could be applied to quantify critical floodplain habitat at the project site, if specific coho rearing habitat inundation criteria (timing, depth, duration) is identified for coastal stream floodplains.

For the EIR/EIS analysis, we have mapped expected winter rearing habitat areas at the project site based on:

- estimations of winter flow conditions (base and winter storm flows) derived from historic flow data;

- approximate areas of inundation for existing conditions based on available topographic mapping, hydraulic modeling results, supplemental hydraulic calculations, and visual observations; and
- expected areas of inundation for proposed project conditions based on topographic mapping, preliminary design dimensions, and supplemental hydraulic calculations.

Given the smaller scale of the site, this mapping approach seems sufficiently detailed to allow comparison of habitat quality and quantity under design and existing conditions.

Conclusions

In summary, the Preferred Alternative would result in an increase in the quality and quantity of winter-spring baseflow habitat for juvenile salmonids. Under conservative estimates, there would be a minimal (0.2 acre) reduction in the areal extent of annually flooded areas using conservative estimates for the proposed project design. However, with the opportunities provided by regrading the area at and around the existing parking lot, it has the potential to increase the total area available for use as floodplain habitat in an annual event by up to 2.1 acres. There would be no reduction in floodplain area under 2-year storm or larger events. In addition, it would result in a great increase in the value of floodplain habitat by eliminating barriers to migration that currently put fish at risk of stranding and allow connectivity to baseflow habitats. Lastly, the preferred alternative would provide a relatively greater amount of backwater habitat that is available to fish during winter-spring baseflow conditions as well as larger storm events. This is in contrast to the existing condition, under which there is a preponderance of floodplain habitat that is only inundated during larger storm events. As such, the majority of winter rearing habitat under the preferred alternative would be available throughout the entire winter season, rather than only during storm conditions. For these reasons, NPS believes that the preferred alternative will serve to provide improved winter-spring rearing habitat compared to existing conditions.

MR-3 Sea Level Rise

Historically, the morphology of the seasonally brackish lagoon, or the Big Lagoon, was determined by the relative influence of sea level rise, sedimentation from Redwood Creek, and beach sand transport processes. Over the last 5,000 years, sedimentation rates were equaled or exceeded by sea level rise (approximately 0.5 feet per 100 years). Because sea level rise more or less kept pace with sedimentation rates, the Big Lagoon likely sustained the same approximate size until Euro American disturbances began in the 19th century. The Feasibility Study (PWA 2004), examined the long-term sustainability of the Big Lagoon and other Restoration Alternatives, given current and future estimated rates of sea level rise and sediment delivery.

This MR addresses multiple comments received regarding sea level rise and is intended to answer the following questions.

1. Was the sea level rise value used in the previous analysis consistent with the latest 2007 recommendations from the IPCC[6]?
2. What are the potential effects of sea level rise on the project?
3. What would be the potential magnitude of these effects if actual sea level rise is greater than the predicted value of 0.7 feet over the next 50 years?

1. Was the sea level rise value used in the previous analysis consistent with the latest 2007 recommendations from the IPCC? Climate change simulations project a substantial rate of global sea level rise over the next century because of thermal expansion as the oceans warm and as runoff from melting land-based snow and ice accelerates. In the analysis to date, sea level rise was estimated at 0.7 feet over the 50-year planning horizon based on the 2001 IPCC study[7]. (This value was the median of the range of projections included in that study.)

In 2007, the IPCC published updated estimates for global sea level rise as shown in Table 6-3. Using the same approach described above, an average value of sea level rise over the 50-year planning horizon would be 0.54 feet[8]. Therefore, the previous estimate of 0.7 feet of sea level rise is still within the range of IPCC's most current estimates.

Given the latest IPCC data and the previous estimated rate of sea level rise, our 50-year predictions of future site evolution for each Restoration Alternative remain unchanged. However, the potential effects of sea level rise over a longer planning horizon, such as 100 years, are also discussed below. Note that sea level rise will not stop after 50 or 100 years, but will continue for millennia.

[6] Values used in the EIR/EIS were derived from the third IPCC assessment report published in 2001 and the latest IPCC data updated in 2007.

[7] **IPCC (2001)** predicted global average sea level rise of between 0.30 and 2.89 feet with a central value of 1.57 feet for 1990–2100 using six emissions scenarios (B1, A1T, B2, A1B, A2, and A1F1). Over a 50-year period, and assuming a linear rate of rise over the 21st century, this equates to between 0.13 and 1.31 feet with a central value of 0.72 feet (the value used in the Big Lagoon report).

[8] **IPCC (2007)** predicted global average sea level rise between 1980/1999 and 2090/2099 (approximately 105 years) of between 0.59 and 1.94 feet based on six different emissions scenarios. This would translate to a predicted rise of 0.28 to 0.92 feet over 50 years, with an average of 0.54 feet, assuming a linear rate during the 21st century. However, because the IPCC (2007) data show that the rate likely will increase with time, the assumption of a linear rate likely overestimates the 50-year projection. This may be offset by the fact that the lower range of IPCC projections is based on model runs that are known to underestimate past sea level rise; as such, these model runs may not be plausible projections of future sea level rise and would bias the average downward.
Also, note that the IPCC 2007 projections include only thermal expansion and melt from glaciers and ice caps excluding Greenland and Antarctica and do not include "future rapid dynamical changes in ice flow," which could contribute up to 4 to 6 meters of sea level rise over the next millennium. Scientists currently do not have the capability to model nonlinear dynamics of the Greenland and Antarctic ice sheets. IPCC has based their projections solely on models and acknowledges this shortcoming in the 2007 report. The extent to which this issue could affect sea level rise within the 50-year planning time horizon of the project is not predictable.

Table 6-3. IPCC (2007) Sea-level Rise Estimates (2090–2099 relative to 1980–1999)

Emissions Scenario	1990–2095 (105 years)			2010–2060 (50 years)		
	Low (feet)	High (feet)	Mid-Point (feet)	Low (feet)	High (feet)	Mid-Point (feet)
B1	0.59	1.25	0.92	0.28	0.59	0.44
A1T	0.66	1.48	1.07	0.31	0.70	0.51
B2	0.66	1.41	1.03	0.31	0.67	0.49
A1B	0.69	1.57	1.13	0.33	0.75	0.54
A2	0.75	1.67	1.21	0.36	0.80	0.58
A1F1	0.85	1.94	1.39	0.41	0.92	0.66
Average	0.70	1.55	1.13	0.33	0.74	**0.54**

The maximum sea level rise predicted by IPCC (2007) over the next 50 and 100 years is approximately 0.92 feet and 1.94 feet, respectively (for emissions scenario A1F1)[9]. The implications of these higher values are discussed further in our response to Questions 2 and 3.

2. What are the potential effects of sea level rise on the site? Sea level rise likely would have the following general effects on the site (either with or without the project).

1. With sea level rise, the extent of tidal influence would shift landward (upstream), converting some wetlands from freshwater to more salt-tolerant vegetation types.
2. Water levels at the downstream end of Redwood Creek (i.e., below Pacific Way) would increase during storm events. This would increase the duration and extent of out-of-bank flooding and could increase flooding of some infrastructure, including the parking lot and portions of Pacific Way.
3. Groundwater levels toward the downstream end of the project would increase, creating more saturated soils that could convert lower-lying riparian areas to wetland habitats. The net increase in groundwater levels would increase, but not necessarily linearly, with sea level rise. (Groundwater levels at the beach would be approximately match the increased mean sea level; the net increase in groundwater levels would likely taper off with increased distance from the beach.)
4. The beach, and likely the tidal lagoon, would migrate landward. During large storm events, the parking lot would be more likely to be flooded because of storm surge and wave action. However, the increased storm

[9] It should be noted that these values reflect *global* sea level rise, rather than *relative* sea level rise, which considers the combined effects of land movements (subsidence or uplift) as well as static sea level rise, or other factors that could affect local sea level rise. (The magnitude of land movements over the next 100 years was considered too unpredictable to be incorporated into this study.)

surge potential would be somewhat offset by reconfiguring the parking lot away from direct wave action, as in Public Access Alternative B4.

3. What would be the potential effects if the actual value of sea level rise were greater than the predicted value of 0.7 feet over the next 50 years? Based on the latest available data, the selection of 0.7 feet sea level rise within the 50-year planning horizon appears reasonable. However, given the amount of uncertainty and variable parameters affecting sea level rise, it is prudent to consider the potential effects of the "worst case" sea level rise estimates over a longer planning horizon, such as 100 years. As stated above, the maximum sea level rise predicted by IPCC over 100 years is approximately 2 feet. It is acknowledged that IPPC estimates do not include melting of the Greenland and Antarctic ice sheets, which could contribute up to 4 to 6 meters of sea level rise over the next millennium. Scientists currently do not have the capability to model nonlinear dynamics of the Greenland and Antarctic ice sheets. As a result, the extent to which this issue could affect sea level rise within the 50-year planning time horizon of the project, or a longer timeframe, is not predictable, and therefore has not been used as the basis for project design.

While existing models do not have the capability to represent the ice sheets, Cayan et al. (2006) from the California Climate Change Center predicted global sea level rise over the next 50 and 100 years using IPCC emission scenarios B1, A2, and A1f1, including sea level rise attributable to melting ice sheets and glaciers. Cayan et al. (2006) predicted that sea level rise could range from 0.1 meter to 0.9 meter per 100 years (or from 0.2 meter to 0.9 meter for the worst case scenario, A1f1). Therefore, the high end of the estimated range for the worst case emission scenario is close to 1 meter over 100 years.

If such extreme events were to occur, they would not necessarily be incompatible with the restoration of the project site, nor would they completely eliminate its benefits compared to the No Action alternative. In addition, much larger planning issues would come into play, such as flooding of Highway 1 and other regional issues related to flooding in low-lying areas.

To help put impacts of sea level rise into perspective, the potential effects of up to 2 feet of sea level rise are discussed qualitatively below. Please note that these are general predictions and limited in their accuracy by several factors (e.g., natural variability and unpredictability and effects of large, episodic disturbances). The potential for more rapid sea level rise caused by melting of the Greenland and Antarctic ice sheets would cause the effects discussed below to be more extreme; this is also addressed more specifically in the discussion below.

Tidal Influence Shifting Landward

Currently, when the sand bar is open, the channel flow is intertidal from the ocean to an area in the vicinity of the existing footbridge. (The exact limit of the tidal interface varies as the channel bed is constantly adjusting in response to sediment loading, storm events, etc.) With 2 feet of sea level rise, the extent of tidal influence would shift landward (upstream) roughly 800 feet (assuming a

channel slope of 0.25%). Much of the realigned Redwood Creek within Green Gulch pasture, as well as some of the backwater channels, would become intertidal. The willow thicket and other vegetation seaward of the existing parking lot may convert to more salt-tolerant vegetation. The magnitude of this change is expected to be similar with or without the proposed project. More extreme sea level rise would cause tidal influence to shift even further inland.

Increased Flood Levels

Higher tide levels at the channel mouth will raise flood levels a certain distance upstream. The distance varies depending on the magnitude of storm rainfall and runoff, variable tide levels at the beach, and the timing of peak tidal and streamflow conditions.

Earlier model runs were performed to assess relative differences between Restoration Alternatives, rather than to evaluate worst-case flooding conditions. Therefore, we assumed a downstream tidal level of 3 feet NGVD (based on MHHW) coincident with the flood peak for all model runs. (This is a relatively common assumption for modeling tidally influenced fluvial systems and consistent with certain FEMA guidance.) We acknowledge that during storm events, water levels at the beach and in the lagoon can be significantly elevated because of processes affecting the whole coast, including high astronomical tides and coastal shelf storm surges as well as processes site specific to Muir Beach such as south swell setup and wave run-up into the lagoon.

In response to public comments on the Draft EIS/EIR, we used the hydraulic model to test the potential for more extreme downstream tidal conditions to influence upstream flood levels. This would provide an indication of how ocean water levels influence upstream flow stages to assess the potential impact of sea level rise. Both existing and design conditions were modeled, with two different tide levels.

For existing conditions, we modeled a hypothetical event selected to roughly simulate the December 31, 2005, event, the largest recent storm event of record (an actual event was selected to roughly calibrate results to observed conditions, rather than using a completely hypothetical scenario). For design conditions, we used a 2-year floodflow (peak of 805 cfs).

For both scenarios, to represent sea level rise, we estimated tidal conditions about 100 feet downstream of the footbridge to be 9.5 feet NGVD, 4 feet above normal tide level. This tide level was based on the measured peak tide level (5.5 feet per NOAA Fisheries, Tides and Currents) and rough estimates of wind setup and wave run-up at 0.5 and 3.5 feet, respectively, and appears to be consistent with local observations. This is considered a valid method of representing sea level rise, since sea level rise would be equivalent to a high tide which is sustained indefinitely. For comparison, we also simulated the same events using a lower tide level of 3 feet NGVD (MHHW), similar to earlier hydraulic model runs.

Figure 6-3 shows the changes in water levels because of varying tidal levels at the downstream boundary under both existing and design conditions. These modeling results have the following implications.

- Under both existing and design conditions, raising the tide level by 6.5 feet above existing MHHW potentially increases water levels upstream of the existing footbridge by less than 1 foot. The maximum increase for existing and design conditions, which occurs in the vicinity of the footbridge and parking lot, is approximately 0.2 and 0.5 feet, respectively.
- The water level increase extends farther upstream under design conditions as compared to existing conditions. However, under both existing and design conditions, the water level increases attributable to raising the tide levels 6.5 feet do not extend up to Pacific Way.
- For the 2-year storm event, flood levels under design conditions are predicted to be 1 to 2 feet lower than existing conditions from the upstream project limit down to the footbridge.

Therefore, sea level rise will potentially affect flood levels at existing infrastructure, especially downstream of the Pacific Way bridge (e.g., at the parking lot and at nearby homes on Pacific Way). However, there is no indication that the proposed project could increase flooding potential over existing conditions.

Increased flood levels downstream of Pacific Way would increase the frequency, depth, and duration of out-of-bank flows on the floodplain, which is expected to improve winter rearing habitat for salmonids.

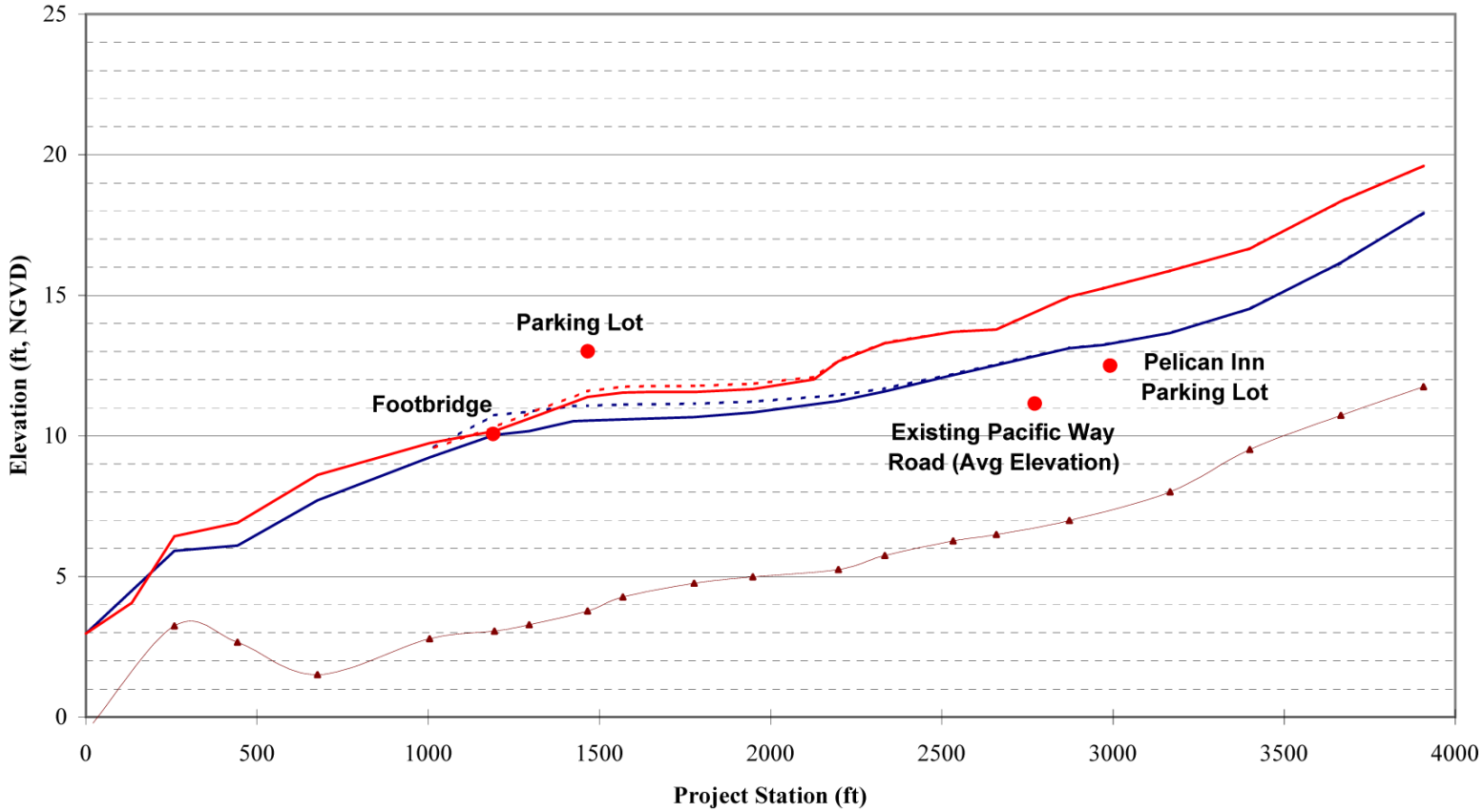
Raised Groundwater Levels

We have predicted that the preferred alternative would initially lower groundwater levels (e.g., in the Green Gulch pasture) by roughly 1 foot because of improved drainage. Over time, the groundwater levels are expected to gradually increase because of sea level rise. Increased groundwater levels may alter future habitat predictions presented in the EIS/EIR; we would expect wetlands to replace riparian habitat. Extreme levels of sea level rise could ultimately lead to conditions more similar to the historic “Big Lagoon” that existed at the site in the mid-1800’s.

Beach Retreat

Over the next century, the beach and likely the tidal lagoon are expected to migrate landward because of sea level rise. During large storm events, the existing parking lot would be more likely to be flooded as a result of storm surge and wave action. As proposed in the Final EIS/EIR, preferred parking lot alternative B4 would be rotated to allow more room for beach retreat and may result in the creation of sand dunes in the restored area of the existing lot. Two

feet of sea level rise would cause approximately 80 to 100 feet of beach retreat, assuming the existing beach profile remains relatively unchanged. More extreme levels of sea level rise would cause beach retreat to migrate further inland. It is likely that there will be some aggradation of the beach, counteracting beach retreat.



Notes: Alternative and spot elevation changes based on Alternative 1 MIKE network.
Mean Tide = 0.3 feet NGVD (mean higher high water or MHHW)
Extreme Tide = 9.5 feet NGVD (based roughly on 5.5 feet static tide level, plus storm surge & wave runup)

- Design Conditions (Alt 2, 150' Bridge) - Mean High Higher Water
- Design Conditions (Alt 2, 150' Bridge - Extreme Tide
- Existing Conditions (Alt 1) - Mean High Higher Water
- Existing Conditions (Alt 2) - Extreme Tide
- Alternative 2 Thalweg
- Spot Elevations

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Jones & Stokes

Figure 6-3
Comparison of Redwood Creek Water Levels for 2-year Flow and Variable Tidal Conditions

Exhibit 2: Final Environmental Impact Statement

A

FEDERATED INDIANS OF GRATON RANCHERIA

Sacred Sites Protection Committee
P.O. Box 14428
Santa Rosa, CA 95402
707- 566-2288

RECEIVED
FEB 27 2007
SUPERINTENDENT'S OFFICE

SUSPENSED CORRESPONDENCE 2/27
ACTION PERSON: Craig Kenkel
REPLY DUE
SUPT'S OFC: Mar 13, 2007
PWR/OTHER:
COPIES PROVIDED OR FORWARDED VIA E-MAIL P.07- 7.1
Bartling
File
Paul Scolari

February 24, 2007

Superintendent
Golden Gate National Recreation Area
Fort Mason, Building 201
San Francisco, CA 941232
Attn: Restoration at Big Lagoon

RE: SCH # 2004042143
Wetland and Creek Restoration
Big Lagoon and Redwood Creek
Comment on DEIR

Thank you for the opportunity to comment on this project's DEIR. The Federated Indians of Graton Rancheria (FIGR) has appreciated the consultation on this project with Golden Gate National Recreation Area and in particular with Leo Barker and Paul Scolari. The respect they have demonstrated for our cultural resources and our culture is appreciated and is documented by the appropriate types of mitigation measures in the plan. A-1

We have the following one comment on the plan. On page 4-208, the current plan states a FIGR monitor is required during soil excavation "in the vicinity" of cultural resources. In other places there are references requiring monitoring by an archaeologist when soil disturbance occurs "within 100 feet". We request monitoring by a FIGR representative be changed to match the archaeologist, "within100 feet". A-2

Since this project area is considered a "cultural landscape", there is a high probability cultural resources can be discovered anywhere in the work area. The frequent movement of soils and the resources they contain, including human remains, may have been dispersed from their original location. Therefore, we request a Native American monitor from FIGR be present during soil disturbance within 100 feet of a known site.

Thank you for respect and assistance,

Nick Tipon
For the Sacred Sites Protection Committee

DEPARTMENT OF THE INTERIOR
SPECIAL
DI-1
(August 1985)

Letter A: Federated Indians of Graton Rancheria (February 27, 2007)

Response to Comment A-1

Thank you for your comment. It is a mission of NPS to protect cultural resources. We look forward to continuing to work together to protect the cultural resources of the Federated Indians of Graton Rancheria (FIGR).

Response to Comment A-2

All references to monitoring ground disturbance activity during construction will be changed to state that an FIGR representative will be present when soil disturbance or excavation occurs within 100 feet of a previously identified cultural resource. Please see revisions to Mitigation Measure CR-MM1: Cultural Resources Education, Archaeological Monitoring, and Discovery Measures.

B

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

RECEIVED
MAR 13 2007

February 28, 2007

Brian O'Neill, Superintendent
Golden Gate National Recreation Area
Fort Mason, Building 201
San Francisco, CA 94123

Attn: Muir Beach Creek and Wetland Restoration

Subject: Wetland and Creek Restoration at Big Lagoon, Muir Beach Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR), Marin County, California [CEQ #20060514]

Dear Mr. O'Neill:

The U.S. Environmental Protection Agency (EPA) has reviewed the above referenced document. Our review and comments are provided pursuant to the National Environmental Policy Act (NEPA), the Council on Environmental Quality's (CEQ) NEPA Implementation Regulations at 40 CFR 1500-1508, and our NEPA review authority under Section 309 of the Clean Air Act.

B-1

EPA supports the purpose and goals of the project and believes the preferred alternative will help restore a functional, self-sustaining ecosystem in the project area while reducing flooding on Pacific Way and providing a compatible visitor experience. We have, therefore, rated this Draft EIS/EIR as LO – Lack of Objections (see enclosed "Summary of Rating Definitions").

The Draft EIS/EIR indicates that a spill prevention, control, and countermeasures (SPCC) plan will be developed before construction begins. It will be critical to minimize potential impacts from spills during construction/restoration activities in this highly sensitive project area. We recommend the SPCC plan be outlined in the Final EIS/EIR. The National Park Service's recent Giacomini Wetlands Restoration Draft EIS/EIR (p. 93) identifies several important elements of the SPCC plan for that project. We recommend those measures be incorporated into the SPCC plan for the Big Lagoon project, along with following additional measures.

B-2

- A spill kit with boom and sorbent materials should be on site at all times during construction;
- No vehicles will be fueled, lubricated, or otherwise serviced within 100 feet of the normal high-water area of any surface water body.

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We also recommend you contact Peter Reich in EPA Region 9's Oil Program at 415-972-3052 to discuss the project's intended operations to ensure compliance with any oil spill regulations that may apply to the project. B-2 cont.

We appreciate the opportunity to review this Draft EIS/EIR and request a copy of the Final EIS/EIR when it is officially filed with our Washington, D.C., office. If you have any questions, please call me at (415) 972-3846, or have your staff call Jeanne Geselbracht at (415) 972-3853.

Sincerely,

Nova Blazej, Manager
Environmental Review Office

004917

Enclosure: Summary of Rating Definitions

cc: Marin County Community Development Agency

2

SUMMARY OF EPA RATING DEFINITIONS

This rating system was developed as a means to summarize EPA's level of concern with a proposed action. The ratings are a combination of alphabetical categories for evaluation of the environmental impacts of the proposal and numerical categories for evaluation of the adequacy of the EIS.

ENVIRONMENTAL IMPACT OF THE ACTION

"LO" (Lack of Objections)

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

"EC" (Environmental Concerns)

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

"EO" (Environmental Objections)

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

"EU" (Environmentally Unsatisfactory)

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

ADEQUACY OF THE IMPACT STATEMENT

Category 1" (Adequate)

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

"Category 2" (Insufficient Information)

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analysed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

"Category 3" (Inadequate)

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analysed in the draft EIS, which should be analysed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

Letter B: United States Environmental Protection Agency (February 28, 2007)

Response to Comment B-1

Thank you for your comment. The NPS appreciates the support of the U.S. Environmental Protection Agency.

Response to Comment B-2

As required in Mitigation Measure WQ-MM-2: Implement Spill Prevention and Control Plan, NPS will develop and implement measures to minimize water quality impacts attributable to hazardous spills and other sources and mechanisms of pollutants during construction activities. This plan will be prepared during project design and is not included in this document. NPS will consider the measures included in the Giacomini Wetlands Restoration Draft EIS/EIR and other suggested measures during development of the plan. . Additionally, NPS will comply with conditions of permits as required by regulatory agencies, such as the San Francisco Bay RWQCB, to further ensure that human and environmental health is protected during project construction.

C

STATE OF CALIFORNIA – THE RESOURCES AGENCY ARNOLD SCHWARZENEGGER, GOVERNOR

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SUPERINTENDENT'S OFFICE

March 6, 2007

Brian O'Neill
Superintendent
Golden Gate National Recreation Area
Fort Mason, building 201
San Francisco, CA 94123

RE: DEIR/EIS Wetland and Creek Restoration at Big Lagoon, Muir Beach

Dear Mr. O'Neill:

Thank you for the opportunity to review and comment on the Draft Environmental Impact Statement/Environmental Impact Report for Wetland and Creek Restoration at Big Lagoon, Muir Beach, dated December 2006. The Golden Gate National Recreation Area (GGNRA) proposes to restore a functional, self-sustaining ecosystem, and provide for public access that is compatible with restoration. The 38-acre project site is located entirely within the boundaries of the GGNRA, but includes some properties owned by the San Francisco Zen Center and Marin County.

The preferred alternative consists of Restoration Alternative 2 – Creek Restoration, Public Access Alternative B3 – 175 cars at the beach with a horizontal orientation, and Bridge Alternative BR3 – 150 foot-long bridge with raised road. Fill material will be disposed of at the Unused Reservoir Pit about 2 miles north of the project site.

The GGNRA is required to submit a consistency determination for this project, due to its impacts on the coastal zone.[1] This regulatory requirement arises under Section 307 of the federal Coastal Zone Management Act.[2] The consistency determination should include a finding as to whether the activities are consistent with the California Coastal Management Program, and the necessary information to support that conclusion, including an analysis of the project's consistency with the applicable Chapter 3 policies of the Coastal Act. (See CFR Section 930.58 for a full listing of the information required for a complete consistency certification). C-1

In general, the staff believes the project proposal would improve the biological processes at Big Lagoon, but only minimally. The alternatives do not seem to be designed for maximum biological productivity in terms of: a) the creek alternative versus a lagoon alternative, b) taking into account effects of global warming on the coastal zone, or c) the long-term management of the area. This letter does not express the full range of our concerns regarding this project, as our staff biologist has not yet had the opportunity to evaluate the proposed project and C-2

1 16 U.S.C. Section 1456, with implementing regulations at 15CFR Part 930.

2 16 U.S.C. Section 1456, with implementing regulations at 15CFR Part 930.

Wetland and Creek Restoration at Big Lagoon, Muir Beach
Page 2 of 4

alternatives. The following comments focus on the project's consistency with relevant Coastal Act policies. C-2 cont.

Public Access

Coastal Act § 30210 states in part

> *In carrying out the requirement of Section 4 of Article X of the California Constitution, maximum access, which shall be conspicuously posted, and recreational opportunities shall be provided for all the people consistent with … the need to protect … natural resource areas from overuse.*

The DEIR/EIS should address the issue of visitor overuse at Muir Beach and attendant facilities areas, including the contribution made by the existing capacity of the parking lot. The "Visitor Management at Muir Woods and Muir Beach" study (Manning, et alia 2004) indicates that most visitors—over 440,000 annually—do not report feeling overcrowded, but the DEIR/EIS does not evaluate the effects of visitor use levels on natural resources, in particular, at the beach. A measure of use levels compatible with protection of natural resources should be established. C-3

Coastal Act § 30233 (c) states in part

> *Any alteration of coastal wetlands identified by the Department of Fish and Game, including, but not limited to, the 19 coastal wetlands identified in its report entitled, "Acquisition Priorities of the Coastal Wetlands of California", shall be limited to very minor incidental public facilities…*

GGNRA should evaluate the potential benefits of year-round public transportation directly to Muir Beach, with a parking scheme designed to promote the use of public transportation. A rejected alternative described in the DEIR/EIS included a transit stop on Highway 1, as opposed to a transit stop at Muir Beach. This alternative was rightly rejected, not least because it would create a situation where only those on public transportation would be inconvenienced by having to walk the remaining distance to Muir Beach, while those that drive cars would have the advantage of parking at the beach. Any public transportation alternative should include service directly to Muir Beach. C-4

The DEIR/EIS mentions a bus line that provides service to the vicinity of Muir Beach which is no longer in service. That reference should be excluded from the DEIR/EIS. C-5

Page 2-22 of the DEIR/EIS alludes to, but does not describe, "County plans" to improve transit pull-offs on Highway 1. These plans should be described and incorporated into the project. C-6 Public Access Alternative C – 118 Cars at Alder Grove plus 14 Disabled-Accessible Parking Spaces and Drop-off at Beach should be reconsidered, and the relegation of this alternative to less than "preferred" status should be re-evaluated. C-7

On page 2-43 Public Access Alternatives B3—175 Cars at the Beach (Horizontal) and B4—175 Cars at the Beach (Vertical) are compared. The evaluation of these alternatives includes a C-8

Wetland and Creek Restoration at Big Lagoon, Muir Beach
Page 3 of 4

"cost-benefit" analysis. For federal consistency purposes "cost-benefit" is not a deciding factor, although economic factors may be part of feasibility considerations. C-8 cont.

Wetland Restoration

Coastal Act § 30231 states

> *The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface waterflow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.*

All restoration alternatives for the project assume the long-term functioning of the area in the absence of active management. Each scenario of conditions 50 years hence anticipates a marked decrease in wetlands due, primarily, to vegetation succession. The biological productivity of this wetland/lagoon area cannot be sustained without maintenance and anthropogenic interference. These actions would seem entirely reasonable at Big Lagoon in light of the historical, aggressive, maintenance activities of the Native Americans documented by M. Kat Anderson (U.C. Davis), and the findings of Longcore, Mattoni, et alia,[3] (attached) regarding the requirements for successful restoration efforts. Those findings emphasize the importance of long-term maintenance for restoration success. The Big Lagoon area should be maintained for maximum biological productivity, and all alternatives should be evaluated in this light. C-9

Table 2-8 Alternatives Comparison Summary on page 2-50 is missing two pieces of information that would appear to be important in comparing restoration alternatives: in Restoration Alternative 2—Creek Restoration, the number of haul trips of dredged materials should be included in Adverse Effects, and in Restoration Alternative 4—Large Lagoon Restoration, corollary benefits to bird species should be included in Beneficial Effects. C-10

On page 4-119, the vegetated swales in the parking lot are described as not providing high levels of ecological function, and as only potentially providing some filtering capacity for the parking lot. These bio-swales should be designed specifically for filtering hydro-carbon and other petroleum-based pollutants resulting from the high use levels of the parking lot, or the existing design should be shown to be adequate to do so. C-11

Thank you for the opportunity to comment on the Draft EIR/EIS for the Wetland and Creek Restoration at Big Lagoon, Muir Beach. We look forward to working closely with you and your

---

[3] Longcore, T., R. Mattoni, G. Pratt, and C. Rich. 2000. On the perils of ecological restoration: lessons from the El Segundo blue butterfly. Pp. 281-286 in Keeley, J., M. Baer-Keeley, and C. J. Fotheringham, eds. *2nd Interface Between Ecology and Land Development in California*, U.S. Geological Survey Open-File Report 00-62, Sacramento, CA.

Wetland and Creek Restoration at Big Lagoon, Muir Beach
Page 4 of 4

staff throughout the consistency determination process for this project. If you have questions, please contact me at 415-904-5250, dlivia@coastal.ca.gov. If you have questions about the federal consistency process, please contact Larry Simon, the Commission's federal consistency coordinator, at 415-904-5288.

Sincerely,

Diane Livia
Federal Consistency Analyst

cc: Carolyn Shoulders, NPS

Letter C: California Coastal Commission (March 6, 2007)

Response to Comment C-1

The comment is noted. NPS will submit a consistency determination to the California Coastal Commission pursuant to the requirements of Section 307 of the federal Coastal Zone Management Act.

Response to Comment C-2

The Commission's concern is noted. Maximum biological productivity, in and of itself, is not a goal of the restoration project. The purpose of the project is to restore a functional, self-sustaining ecosystem, including wetlands, riparian habitat, and habitat for sustainable populations of special-status species, including salmonids. The proposed actions will meet this goal and allow the most natural function at the site in almost a century. The substantial existing constraints on natural function due to infrastructure will be largely erased by project actions; and the aquatic system, with its diverse sub-habitats, will be allowed to evolve in response to natural processes.

Creek Alternative versus Lagoon Alternative. Restoration Alternative 2 (creek alternative) will enhance both biological processes and physical processes. Please note that the lagoon alternatives (Restoration Alternatives 3 and 4) would not have universal beneficial impacts for biological resources. Some habitat qualities could have been further enhanced under Restoration Alternatives 3 or 4, particularly for juvenile salmonid habitat; but Restoration Alternatives 3 and 4 also posed some added risk of adverse impacts for the federally threatened California red-legged frog. Neither Restoration Alternative 3 nor 4 were selected because of their substantial added construction impacts for minimal added benefits and the fact that excavated ponds are likely to refill with sediment, eventually returning the site to a landscape similar to that of Restoration Alternative 2. Please also see Response MR-2 about the likely increase in the extent of annual winter habitat for salmonids in Restoration Alternative 2.

Restoration Alternative 2 will substantially enhance both the quantity and quality of winter-spring habitat for juvenile salmonids, one of the most critical needs for the federally listed coho and steelhead in Redwood Creek. During greater than average winter events, most of the riparian and wetland habitat in the 38-acre project site will be inundated, providing essential floodplain habitat for juvenile salmonids; but for the first time since the 1920's, the floodplain will be fully connected and unconfined. Juvenile salmonids will be more likely to reenter the creek from the floodplain, and they will have expanded area for refugia and food sources. (See also Response MR-2, which focuses on the gain in winter-spring habitat during a 1-year flow event).

Global Warming. The DEIS/EIR did include analyses of projected sea level rise, but this topic is further addressed in MR-3 (p. 6-12), which discusses the IPCC's 2001 and 2007 projections for sea level rise, the potential effects of sea level rise on the project area, and the potential magnitude of effects if sea level rise is much greater than the value used in the project analyses. Also, the change in the preferred bridge alternative in this Final EIS/EIR to the longest feasible bridge (BR4) is based partially on an understanding that it is the best choice given the uncertainties in flood elevations related to future sea level rise (see also Letter F). The longest feasible bridge provides the maximum benefits no matter what the future scenario is. Similarly, the rotation of the parking lot creates extensive new capacity for geomorphic processes that may occur during large storms or storm surges. One of the best actions that can be taken to plan for rising sea level is to remove infrastructure that impedes geomorphic processes. The project as proposed will achieve the critical need to anticipate effects of not only sea level rise but other possible changes in storm event patterns due to global climate change, while also accommodating visitor and residential access.

Long-term Management. With respect to long-term management, the project has been designed to reduce and minimize the need for active management in the project area into the future by returning more sustainable fluvial processes to the site. The project removes infrastructure that has created the need for management that is often controversial and difficult to permit. The infrastructure (the bridge, the parking lot, and the levee) at the site restricts flow conveyance and sediment transport, which has caused flood elevations to increase and created a need for periodic maintenance dredging to improve flow conveyance. The selection of the longest bridge (BR4) and the rotated parking lot, together with a more natural channel alignment, function together to substantially reduce the need for long term maintenance that can be detrimental to natural resources. Long-term management would include monitoring and adaptive management but many natural changes in the fluvial system would not be considered triggers for management actions. Additional information on long-term management related to vegetation is provided in Response C-9.

Response to Comment C-3

NPS shares the Coastal Commission's concern for Muir Beach's sensitive natural resources; NPS Management Policies specifically emphasize the need to provide uses that are "appropriate to the superlative natural … resources found in [its] parks" and can be sustained without "unacceptable impacts" on park resources or values (NPS Management Policies 2006 Section 8.2).

Consistent with these policies, Muir Beach has been managed to allow limited, site-appropriate visitor access since it was added to the National Park System in 1972 (PWA 1994). A recent survey of visitor experience did, in fact, find that visitors at Muir Beach do not report feeling overcrowded, and further observations suggest that resources at the site are best protected through specific site management actions rather than a reduction in the number of visitors.

As discussed in Chapter 4, Section 4.3.4.1 *Recreation and Visitor Experience*, the proposed actions would reduce impacts of visitors and visitor facilities on natural resources, while neither reducing nor increasing visitation. Impacts of visitors would be reduced because the reconfigured access (bridge, trails, and parking) is designed to minimize the potential for disturbance to aquatic habitats, birds and wildlife. Trails on the site would be relocated to the perimeter of the resource areas, and the existing levee trail through the center of the site would be removed, increasing the connectivity of aquatic habitat and reducing the disturbance that currently results from hikers, equestrians, and vehicle traffic along the levee.

Other actions identified in the Final EIS/EIR which are intended to reduce the impacts of visitation include fencing around dunes at the beach to allow reestablishment of native vegetation. The location and configuration of the pedestrian bridge over Redwood Creek from the parking lot to the beach will be designed so as to minimize the impact of the bridge on creek function.

Existing data shows that shorebird abundance at Muir Beach and Rodeo Beach is substantially lower than that on six other beaches in GGNRA (3 birds/km at Muir Beach compared to 105 birds/km at Ocean Beach South). The low abundance at the beach is attributed to the habitat quality at Muir Beach, not visitation. The findings reported in BeachWatch state: “Whereas Ocean Beach is a long, wide beach that provides an excellent foraging substrate, Muir Beach has coarser grain sands not as suitable for foraging” (Flanagan, 2006). Potential impacts of dogs at the beach – to birds as well as aquatic habitats such as the intermittent tidal lagoon and the creek - are being addressed in a park-wide Negotiated Rulemaking process, not this project.

About eight years ago, NPS took action to reduce the impact of visitation by removing the water fountain at Muir Beach because it was one of the large water users of the area’s only potable water, a well owned by the Muir Beach Community Services District (MBCSD) about a mile upstream. Water extraction from the MBCSD well can affect water surface elevations in Redwood Creek during the low flow period, when conditions for resident coho and steelhead can become critical. To avoid impacts to Redwood Creek from water use by visitors, this project does not propose to reinstate potable water and will continue to offer only non-flush toilets, although improved non-flush toilets, such as vault toilets, are proposed. Current management has not added additional amenitites (e.g. rentals, concessions, etc.) at Muir Beach to avoid increasing visitation levels and the human footprint. NPS also avoids the use of night lighting in order to protect dark skies, and therefore no such features are proposed as part of the new parking lot.

Changes in visitor access to Muir Beach are analyzed in Impact REC-P2, beginning on Draft EIS page 4-229, and Impact TC-P6, beginning on Draft EIS/EIR page 4-257. As discussed in these analyses, parking capacity—and therefore anticipated visitation levels—would remain unchanged under the Preferred Public Access Alternative B4. By retaining existing parking capacity, while modifying the infrastructure that serves visitors, the potential impacts of visitation are likely to be reduced.

The General Management Plan (GMP) is the most appropriate planning process to set visitor use management for Muir Beach, as it is a more comprehensive evaluation of visitor use at the site and in context with the local area. Under Statute 16 USC 1a-7(b), GGNRA's GMPs are required to evaluate visitor carrying capacity. The GMP planning process, which is currently underway by the GGNRA, will evaluate indicators and standards to evaluate impacts of visitors, but will not necessarily be done for all individual sites within the GGNRA. NPS Policies 2006 state that:

> The level of analysis necessary to make decisions about carrying capacities is commensurate with the potential impacts or consequences of the decisions.

In light of the project's design features, the very limited potential for the proposed action to alter long-term use patterns at Muir Beach, and NPS's ongoing commitment and mandate for responsible, low-impact management, the proposed action is not expected to result in adverse effects related to increases in site use.

Response to Comment C-4

The proposed action does not include public transit features; providing public transit is outside the scope of this effort and thus outside the scope of EIS/EIR analysis. However, NPS has a long-term policy of close partnership with state and local governments to ensure park access and connections with external transportation systems, and—as Chapter 1 of the Draft EIS/EIR identifies—one of the proposed action's eight goals is to

> [c]oordinate with local transportation planning efforts to identify project features that are compatible with transportation improvements and consistent with the ecosystem restoration.

Consistent with this goal, NPS will continue to work with the Transit Authority of Marin, the Marin County Department of Public Works, and Caltrans to maximize the "fit" between improvements at Muir Beach and transit service provided by the County.

Response to Comment C-5

Thank you for your comment. The Stage Coach, operated by the Marin County Transit District, used to run weekdays on Shoreline Highway with a stop at Muir Beach. As of April 1, 2007, low ridership prompted the District to reroute the Stage Coach on Panoramic Highway instead of Shoreline Highway, thus discontinuing the Muir Beach stop. The description of the Stage Coach service in the Traffic and Circulation section of Chapter 3, *Affected Environment*, has been updated in the Final EIS/EIR.

Response to Comment C-6

NPS agrees with the commenter regarding the need to coordinate park planning with local transit improvements to ensure broad-based public access to national park resources. However, the County's proposal to improve transit pull-offs along Hwy 1 is a separately proposed and funded effort and is outside the scope of this EIS/EIR.

As discussed in the response to Comment C-4, the proposed action will coordinate with County improvements, including potential upgrades to Hwy 1 transit pull-offs. Nevertheless, the transit pull-off improvements are intended to meet goals that differ substantially from those of the proposed project; the NPS planning process, NEPA, and NEPA implementing regulations all require that NPS select the alternative that would best satisfy the specific purpose and need identified for the proposed action.

Response to Comment C-7

Based on extensive public outreach and environmental analyses, NPS has concluded that Public Access Alternative C is not the best approach to accomplish the proposed action's identified purpose. This parking lot would cause the loss of a mature riparian area, with added losses for new trails through a natural area. Traffic issues on Hwy 1 would be exacerbated by the added ingress/egress. In addition, because there still would have to be a drop-off at the beach, the total area affected by visitors would be expanded. The road to the beach must remain because of its function as access to residences, and leaving the parking lot at the beach causes fewer impacts. No further analysis is warranted.

Response to Comment C-8

The comment regarding cost-benefit considerations in evaluation of alternatives is noted. Preferred alternatives were selected based on their benefits in meeting project goals, not on their costs. NPS requires that large projects follow a value analysis and a choosing-by-advantages process for determining which alternatives best meet the goals of a project. Once the comparative advantages of the alternatives are understood, costs are evaluated to determine whether increased costs result in increased benefits to the project. This is the standard NPS method for analysis of project alternatives. In this project, two of the three alternatives selected as preferred (Bridge Alternative BR4 and Public Access Alternative B4) are not the least expensive alternatives.

Response to Comment C-9

The proposed project is not anticipated to result in loss of wetland areas over time. Vegetation succession does not imply loss of wetlands, but rather a shift from emergent wetland to riparian wetland habitat. The proposed project, as designed, fully complies with the Coastal Zone Management Act. The project will restore functioning hydrological processes in this coastal area, and natural processes will be the least obstructed since the mid-20th century. Biological functions will be enhanced by project measures to create, expand, and reduce fragmentation of sustainable habitat.

As stated in Chapter 1 of the Final EIS/EIR, the goals of the project are to restore a functional, self-sustaining ecosystem, including wetland, aquatic, and riparian components; restore functions in the context of the watershed; and recreate and maintain habitat adequate to support sustainable populations of special status species. Additionally, NPS is designing the project to reduce the need for future maintenance of sediment deposition, channel configuration, etc. NPS is committed to managing vegetation well into the future to ensure that native species become established and nonnative species are reduced. Further, please note that another project goal, stated on p. 1-8, is to work with the Federated Indians of Graton Rancheria to incorporate cultural values and indigenous archeological sites into the restoration design, visitor experience, and site stewardship. Objective 33, on p. 1-13, states, “In addition to the principle of ecological restoration, the landscape design will be informed by the traditional ecological knowledge of the indigenous peoples of the Central California Culture Area, and one indicator for this objective is, “The extent the design and operational management of the restoration employs native plants with traditional cultural uses, and native practices of land management.” This goal, objective and indicator recognize a role for on-going land management in which some anthropogenic effect is incorporated, particularly in relation to vegetation. NPS is familiar with the work of Kat Anderson and its likely impact on future vegetation management actions and stewardship at the site.

By restoring ecosystem functioning and designing the project to be as self-sustaining as is practical, biological productivity at the project site and surrounding area will consequently benefit from the proposed restoration efforts.

Response to Comment C-10

Table 2-8, Alternatives Comparison Summary, has been updated in the Final EIS/EIR as suggested.

Response to Comment C-11

The bio-swales will be designed and managed to filter pollutants from stormwater runoff from the parking lot, thus providing water quality benefits for the project.

D

State of California – The Resources Agency ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF FISH AND GAME
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YOUNTVILLE, CALIFORNIA 94599
(707) 944-5500

February 28, 2007

Mr. Tim Haddad
Marin County Community Development Agency
3501 Civic Center Drive, Room 308
San Rafael, CA 94903

Dear Mr. Haddad:

Subject: Wetland and Creek Restoration at Big Lagoon, Muir Beach, Marin County
Draft EIS/EIR, SCH 2004042143

The Department of Fish and Game (DFG) is generally in support of the proposed Big Lagoon Wetlands and Creek Restoration Project in an effort to restore hydrologic and ecological process and functions to the project area, and in a larger context, restoration of the Redwood Creek watershed. The lead agency, Marin County Community Development Agency, has selected Restoration Alternative 2, Public Access Alternative 3B, and Bridge Alternative BR3 as the preferred Alternatives.

Restoration Alternative 2 involves the relocation of 2,000 linear feet of Redwood Creek to the lowest portion of the valley in an effort to widen the area of accessible floodplain over-bank events, increase sediment transport and channel stability, maintain abandoned channel areas of Redwood Creek as backwater habitat, and maintain select riparian areas in a similar condition to that which currently exists. Other elements of Restoration Alternative 2 include excavation to create emergent wetland habitat in the upper pasture area as well as adjacent to Green Gulch tributaries in support of existing California red-legged frog (CRLF) populations at the site.

Bridge Alternative BR3 includes widening and lengthening the existing Pacific Way vehicle bridge that provides access from Highway 1 to the Muir Beach parking lot. Installation of the proposed 150 foot bridge involves excavation and rebuilding of bridge abutments, installation of supporting piers, off hauling of spoils and other project related activities.

While DFG supports the increase of both CRLF and coho salmon habitat at this site, the population of both species that currently persist at the site is extremely low and possibly subject to local extirpation as the result of implementation of the wetland and riparian creation aspect of this project. Therefore, DFG recommends that take avoidance measures for CRLF include trapping and exclusion requirements beyond that which is outlined in the DEIR; detailed plans should include: incorporation of exclusion fences, pre-construction night surveys to capture adult California red-legged frogs, D-1

Conserving California's Wildlife Since 1870

Mr. Tim Haddad
February 28, 2007
Page 2

pre-construction daytime surveys to capture juvenile transformed California red-legged frogs, possible initial hand vegetation clearing, and close monitoring of pre-construction and construction activities to ensure that take of CRLF is prevented. D-1 cont.

The new Pacific Way vehicle structure will span Redwood Creek which contains habitat for State-listed endangered coho salmon. The installation of both temporary and permanent piles during the construction of the proposed bridge and demolition of the existing bridge has the potential of adversely impacting both adult and juvenile coho salmon. High sound pressure levels (SPL) will be produced, which may result in the instant mortality, delayed mortality, and adverse behavioral effects which could lead to increases in predation and delays in migration of coho salmon. Therefore, DFG recommends the following: all permanent pile driving activities be conducted between July 15 and October 15 to avoid the peak migration of adult and juvenile coho salmon, all reasonable measures (air bubble curtains, vibratory hammers, dewatered coffer dams, etc.) shall be incorporated to ensure that peak underwater SPLs remain below 180 dB at a distance of 10 meters from the pile, all temporary and permanent pile driving activities shall be monitored during the entire project by a qualified fisheries biologist. D-2

Further, a long term adaptive management plan, including performance standards based on the success of created habitats as measured by monitoring of re-vegetation and colonization of plants, animals, and fish, should be developed beyond that which is outlined in Section C-1 of the DEIR. D-3

DFG also encourages the lead agency to work with Green Gulch Farms, Marin Municipal Water District and other diverters in the watershed to dedicate all appropriative water right holdings to instream flow protection for the benefit of coho salmon and other sensitive species within the watershed under Section 1707 of the State Water Code (1707). D-4

Please be advised that a California Endangered Species Act (CESA) Permit must be obtained if the project has the potential to result in take of species of plants or animals listed under CESA, either during construction or over the life of the project. Special status state/federal species and their habitat that potentially occur at this site include but or not limited to: Central California Coast coho salmon, California brown pelican, Willow flycatcher, California red-legged frog, and other species. D-5

For any activity (such as levee removal or creation, bridge construction, stream channel re-alignment, etc.), that will divert or obstruct the natural flow, or change the bed, channel, or bank (which may include associated riparian resources) of a river or stream, or use material from a streambed, DFG may require a Streambed Alteration Agreement D-6

Mr. Tim Haddad
February 28, 2007
Page 3

(SAA), pursuant to Section 1600 et seq. of the Fish and Game Code, with the applicant. Issuance of SAAs is subject to the California Environmental Quality Act (CEQA). DFG, as a responsible agency under CEQA, will consider the CEQA document for the project. To obtain information about the SAA notification process, please access our website at www.dfg.ca.gov/1600; or to request a notification package, contact the Streambed Alteration Program at (707) 944-5520. D-6 cont.

If you have questions, please contact Mr. Jeremy Sarrow, Environmental Scientist, at (707) 944-5573; or Mr. Greg Martinelli, Water Conservation Supervisor, at (707) 944-5570.

Sincerely,

Chuck Armor
Regional Manager
Bay Delta Region

cc: Golden Gate National Recreation Area
Building 201, Ft. Mason
San Francisco, CA 94123
Attention: Restoration at Big Lagoon

State Clearinghouse

Letter D: California Department of Fish and Game (February 28, 2007)

Response to Comment D-1

NPS appreciates the suggestions for additional mitigation measures related to CRLF. These and other additional measures to protect CRLF, as appropriate, will be implemented as part of the USFWS's Biological Opinion. These measures will also be included in the ROD on the EIS/EIR.

Response to Comment D-2

The construction of the Pacific Way bridge may require pile driving, but the need for pile driving cannot be fully determined until a subsurface geotechnical investigation is conducted during the design process for the bridge. While ground-borne vibration quickly attenuates (FTA 1995) and further attenuation occurs at the ground/water interface, sound pressure impacts on fish in nearby water bodies cannot be completely ruled out. High sound pressure levels (SPL) in excess of 180 dB could physically injure and kill juvenile and adult fish as a result of the percussive shock of these activities. Additionally, incubating salmonid embryos are immobile and sensitive to percussion-related energy shock waves. If engineers determine that pile driving is necessary for structural soundness and that sound pressure in Redwood Creek could reach 180 dB, NPS will implement Mitigation Measure FISH-MM-3 to reduce or avoid impacts on fish in the nearby creek. Mitigation Measure FISH-MM-3 is listed below, and the text has been added in the Final EIS/EIR to reflect this information.

Mitigation Measure FISH-MM-3: Avoidance and Monitoring of High Sound Pressure Levels during Pile-Driving Activities.

All permanent pile-driving activities will be conducted between July 15 and October 15 to avoid the peak migration of adult and juvenile coho salmon. All reasonable measures, including the use of vibratory hammers, dewatering, etc., will be incorporated to ensure that peak underwater SPLs in Redwood Creek remain below 180 dB at a distance of 10 meters from the pile; all temporary and permanent pile-driving activities will be monitored by a qualified fish biologist during the entire project.

Response to Comment D-3

A monitoring plan for physical and biological functions of the project will be prepared as part of the design preparation following completion of this EIS/EIR. Physical and biological functions of the project will be monitored according to

the monitoring plan, which will identify goals and performance standards for adaptive management.

Response to Comment D-4

NPS agrees that instream flow protection for water rights in the watershed would be beneficial for coho salmon, but this is beyond of the scope of the proposed project.

Response to Comment D-5

NPS and Marin County will work with regulatory agencies to obtain all pertinent permits.

Response to Comment D-6

NPS and Marin County will work with regulatory agencies to obtain all pertinent permits; however, a Streambed Alteration Agreement is not required for federal actions on federal land (i.e., portions of the project site).

STATE OF CALIFORNIA – THE RESOURCES AGENCY ARNOLD SCHWARZENEGGER, *Governor*

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SUPERINTENDENT'S OFFICE

14 March 2007

Reply To: NPS030131A

Brian O'Neill
General Superintendent
National Park Service
Golden Gate National Recreation Area
Fort Mason
San Francisco, CA 94123

Re: Section 106 Consultation for the Big Lagoon Ecosystem Restoration, Muir Beach, Marin County, CA

Dear Mr. O'Neill:

Thank you for your letter of 31 January 2007, requesting my comment pursuant to the National Historic Preservation Act as amended and the implementing regulations codified at 36 CFR 800 with regards to the above undertaking. You are requesting concurrence with the NPS' determination that the above referenced project will not have an adverse affect on historic properties.

As I understand it, the undertaking consists of the evaluation of alternatives to restore a functional, self-sustaining ecosystem, and provide public access that is compatible with the ecosystem restoration at Big Lagoon, Muir Beach. Under consideration are three restoration alternatives, six public access alternatives, four bridge alternatives, and five fill disposal alternatives for the project.

The NPS has determined that the APE to be the area shown in Figure 1-3 of the accompanying EIS/EIR. As described via telephone, the APE is bounded by Pacific Highway on the north, and the Golden Gate Dairy on the east, and the beach on the west. I find this satisfactory pursuant to 36 CFR 800.4(1).

E-1

Within the APE for this project, there are four historic properties: the Golden Gate Dairy, CA-MRN-333, CA-MRN-674, and the Fan Site. Golden Gate Diary is eligible for inclusion in the NRHP. The Cultural Landscape Initiative Program submitted this project to my office for review and is still currently under review. More information regarding the three archeological sites will be forthcoming.

Until the identification and evaluation portion of the project is complete, I am not able to concur with the finding of effects for this undertaking.

Brian O'Neill
Page 2 of 2

Thank you for considering historic properties as part of your project planning and I look forward to continuing this consultation. If you have any questions, please contact Amanda Blosser of my staff at (916) 654-9010 or e-mail at ablosser@parks.ca.gov.

Sincerely,

Susan K Stratton for

Milford Wayne Donaldson, FAIA
State Historic Preservation Officer

MWD:ab

Letter E: Office of Historic Preservation (March 14, 2007)

Response to Comment E-1

Thank you for your comment. We are continuing the consultation process with the SHPO and will be seeking concurrence on a no adverse effect finding on the proposed project.

F

Author Information

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Correspondence Information

Status: New	**Park Correspondence Log:**
Date Sent: 03/06/2007	**Date Received:** 03/06/2007
Number of Signatures: 1	**Form Letter:** No
Contains Request(s): No	**Type:** Web Form

Official Letterhead of Regional Water Quality Control Board in original

Date: March 6, 2007
File No: 2158.04 (lcf)

Superintendent Brian O'Neill
Golden Gate National Recreation Area
Fort Mason, Building 201
San Francisco, CA 94123
Attn: Restoration at Big Lagoon

Re: Comments on Draft EIR/EIS for Wetland and Creek Restoration at Big Lagoon, Muir Beach

Dear Superintendent O'Neill:

Thank you for the opportunity to comment on the draft EIR/EIS (DEIR/S) for the Wetland and Creek Restoration at Big Lagoon, Muir Beach Project. We have been closely involved with the Project since its inception and have commented on various occasions. In general we are very supportive of this restoration and many aspects of the proposed design. Many of the issues that we have raised throughout the scoping process have been addressed in the DEIR/S. We appreciate the extensive efforts of the GGNRA staff in creating an ongoing public forum and in responding to our technical concerns. However, there are some remaining significant issues that have not been adequately addressed and are discussed below.

Bridge Alternatives

The DEIR/S evaluated several bridge alternatives and used a value analysis approach to determine the selected alternative of 150 feet. The DEIR/S does not provide adequate information to support this decision. The longer bridge with spans of 266-300 feet is shown to have the highest value: providing the most geomorphic value, creating the most stable channel and natural stream function, and reducing flooding to the largest extent. The DEIR/S should fully discuss the basis and conclusions related to the value analysis. In our experience with value analyses, the benefits are often accounted for in a very subjective manner, and therefore the results can be biased. F-1

Typically, the Water Board supports project designs that restore a stream's natural functions, including floodplain connectivity, to the greatest extent possible. This Project has multiple goals including: restoring a F-2

functional self–sustaining ecosystem; reducing flooding on Pacific Way; and identifying and, to the extent possible, mitigating factors that reduce the site's full restoration potential. While the 150-foot bridge with the raised road will reduce flooding and improve the stream natural function, we do not believe that the 150-foot bridge will create a self-sustaining system, nor promote stream natural function to the degree possible. Further, we think there are large uncertainties in the flood level predictions that merit the longer bridge design. A self-sustaining system in the context of this Project includes the criteria that routine maintenance is not required (p. ES-8). Considerations related to this are the following:

• Floodplain connectivity: improved floodplain connectivity results in improved sediment, LWD/debris and flood water transport. The Redwood Creek system transports large annual and episodic sediment loads, and large amounts of LWD/debris. Between 1992/3 and 2002 the reach below Pacific Way experienced 1-4 feet of sediment accretion. The 266 to 300-foot bridge alternative would create the most stable and self-sustaining system by creating greater connectivity to the floodplain for flood flows, sediment, and LWD. While all the bridge alternatives with raised roads do place fill in the floodplain, including the 266 to 300-foot alternative, the latter fills in the floodplain to the smallest extent. To illustrate the effect of filling in the floodplain, it should be noted that in PWA's modeling effort, they state that the raised road is "effectively a weir" (Final Memorandum Related to Bridge Sensitivity Analysis, April 10, 2006, p. 9). F-2 cont.

• Natural Channel function: one purpose of a self-sustaining project is to allow the channel to adjust its banks (bank erosion and migration) and transport sediment and LWD/debris such that channel armoring and maintenance are not required. Since 2002, maintenance dredging and LWD/debris removal has been conducted in this reach to minimize the flooding of Pacific Way. This is both costly and has significant environmental impacts. In order to prevent environmental degradation of the restored Project area, it is essential that the future condition not require this maintenance.

• Unsustainable Channel Migration: the GGNRA has determined that Redwood Creek has a significant potential for avulsion. Reducing this threat has been a main driving force in this Project. Channel avulsion can be caused by many factors including channel aggradation and channel blockage by sediment and LWD/debris. The 266 to 300-foot bridge would have the least likelihood of channel avulsion due to the increase in LWD/debris and sediment transport capacity. Additionally, if an avulsion were to occur, the most adverse impacts would occur if the channel avulsed outside of the bridge abutments. This is much less likely with the longer bridge.

Uncertainties of Bridge Alternatives

Sea Level Rise: There are large uncertainties in the models used to inform the alternative decisions. These include uncertainties in sea level rise and subsequent flood levels, and sediment transport. A much higher sea level rise is currently being predicted than that used in the analysis (pg 3-15). A sea level rise greater than predicted would significantly affect the flood elevations for the different alternatives. The 266-300 foot alternative provides the greatest reduction in modeled flood elevations and therefore would provide the most protection against the uncertainties related to sea level rise. F-3

Sediment Transport: The PWA report cited above states that "sediment deposition upstream of the new bridge will have some effects on flood levels; however the modeling is not accurate enough to predict how quickly sediment will accumulate." Further they state, "the long-term sediment model predictions are not consistent with the observed results" (p. 19). This indicates that flood elevations may be larger than predicted, as a result of unpredicted sediment aggradation upstream of the bridge. Sediment aggradation that increases flooding would necessitate maintenance dredging, which is not consistent with this "self- sustaining restoration plan". Further, in addition to being costly and causing environmental degradation, it will be more difficult to obtain permits post-restoration. F-4

While it may be possible to further refine the sediment transport and flood level modeling, there is a limit to their accuracy due to the many uncertainties in model inputs and model limitations that will be difficult to resolve. For instance, the DEIR/S states "although modeling assumed that sediment would gradually accumulate at the site over the long-term, episodic events in the watershed (e.g., large storms, earthquake, fire) could deliver large amounts of sediment to the site, or other changes in site morphology (e.g., channel avulsion, debris blockages) could alter flooding at the site in ways that are difficult to predict" (p. 4-17). Therefore, rather than relying solely on predicted model results for sediment aggradation and flooding to determine the preferred alternative, alternatives should also be evaluated based on a more mechanistic understanding of how Project components will affect stream geomorphic functions. F-5

Bridge Length, Width and Aesthetic Considerations: At the Marin County Civic Center public hearing, a

comment was made about the need to maintain the community character of Muir Beach, suggesting that the longer bridges, 150 or 266 to 300-foot, might be too obtrusive. Although we support building a project that meets community flood control and community character needs, at the same time we cannot support the building of a restoration project that does not meet the stated environmental restoration objectives. The environmental goals cannot be achieved by the 50-foot bridge, which received a very low rank in the DEIR/S for restoring stream natural function, stream stability, and floodplain connectivity. A 50-foot bridge does not provide room for the proposed 30-foot channel to naturally migrate and meander. This alternative has a much higher risk of avulsion than the other bridge/road fill alternatives. If the creek were to avulse (jump) beyond the bridge abutments, significant flooding and environmental degradation of the Project would occur. The potential for channel avulsion to occur is much higher in this alternative than the others, as it would promote the highest rate of sediment deposition and LWD/debris blockages. As noted above, the raised roadbed required by the shorter bridge lengths would essentially function as a levee to contain the creek within the constrained channel. It would require riprap to stabilize banks and prevent channel migration. Riprap has very low environmental benefit, eliminating trees, shade, and bank habitat. It is also out of character in a natural creek system, and its use would contradict the stated goals of restoring a naturally functioning creek ecosystem. F-6

We also believe that the need for the proposed bridge width should be further explored. The DEIR/S reports contradictory bridge widths, but in all cases they are wider than the existing road. The DEIR/S does not adequately support the need for these widths. It is essential to the success of the project that an alternative that satisfactorily meets environmental, flood reduction and community character goals be developed. This may mean addressing other alternatives that have not been address in the DEIR/S. For example, we are aware of bridges that separate the vehicle and pedestrian access into separate bridges, reducing the magnitude of an individual structure. Another example would be a long causeway, the same width as the existing road, and lower than the proposed bridges, but somewhat higher than the existing road and bridge, that could allow natural channel function and have less impact on community character. The flood reduction benefits would be less than the larger, higher bridges, but would be improved from existing conditions of frequent flooding. Lastly, in terms of aesthetics, we would suggest that the visual impact of a long-length of raised roadbed fill of the 50 or 150-foot bridge vs. the open space beneath the longer 266-300 foot bridge should be evaluated as part of the DEIR/S, particularly considering the environmental benefits of the longest bridge to the creek restoration. F-7 F-8

Salmonid Winter/spring Rearing Habitat, and Winter/spring Flood Refuge for Juveniles and Newly Emerged Fry

The Redwood Creek coho population is critically important to coho recovery in the Central Coast ESU due to its unique genetic character. However, it is also a very small population that is susceptible to extinction if critical habitat components are lost. A full limiting factors analysis has not been completed, but monitoring results from the National Park Service indicate that winter juvenile coho survivorship is relatively high. The reason for this relatively high survivorship is not known, but it is probable that the flooded areas within the Project area provide high flow refuge (juveniles and emerging fry) and rearing habitat. There are very few other areas within the Redwood Creek watershed that can provide this function. In recent years, this area floods several times a year and remains flooded for an extended duration.

Therefore, in the absence of a study clearly identifying population limiting factors, the GGNRA must take a conservative approach and preserve this function of the Project area. It would be preferable to increase the quantity of this habitat, but at a minimum the current extent should be maintained. While several features have been added to the Project in order to maintain this habitat, there is no quantification of this habitat. In order to verify that there will be no decrease in this habitat, the DEIR/S should include a presentation of depth/inundation frequency maps (or some acceptable alternative method of comparing the data) comparing present conditions to future conditions for rearing and refuge habitat. This will necessarily involve making assumptions based on the literature and observations in the Redwood Creek system, of required depths for coho during this life phase. We realize that due to limitations in data available and model limitations, there will be large uncertainty in such mapping; however, it would be on a similar scale as other uncertainties in the Project design. F-9

Additionally, as part of refining the Project design, additional data can be collected to verify the predictions and make design modifications. PWA has conducted work in the Sacramento-San Joaquin system that has led to the identification of the "floodplain activation flow" (FAF) for lands that are frequently flooded and for relatively long durations and have ecological value for fish rearing and carbon production. An abstract describing this work is located in the 4th Biennial CALFED Science Conference 2006 abstracts document. In this abstract, PWA concludes that their work "suggests that it is quite feasible to map and quantify where a specific type of

floodplain occurs".

Water Quality Impacts in backwater channels and flooded areas

The DEIR/S does not discuss water quality during low flow periods in the backwater channels or flooded areas that may not completely drain. If water is ponded in these areas throughout the summer with no freshwater inflows or groundwater flow, they may become anoxic or highly eutrophied. While small areas of anoxic or eutrophied water may not have an adverse impact, large volumes of this water would have a negative impact. Therefore, it's important that the DEIR/S fully evaluate this, and the final Project design take into consideration measures to minimize the volume of this water. F-10

Sand Bar Closure

The DEIR/S (p. 4-35) concludes that none of the alternatives are anticipated to alter the seasonal patterns or processes driving lagoon formation. The potential impact on lagoon closure of the increased size of the tidal lagoon is not explicitly discussed. We believe that this potential impact requires closer scrutiny because unanticipated alterations in the timing of lagoon closure in a few restoration projects along the California coast have created significant negative environmental effects. F-11

Geomorphic Channel Design

The DEIR/S indicates that the SAM model was used to determine stable channel dimensions that will pass a prescribed sediment load without sediment deposition or erosion (p. 4-19). The DEIR/S discussion provides a discussion of the use of the SAM model; however we require further detail on the following:
1. Is the SAM model appropriate for use in an alluvial reach that transitions into an estuarine reach, and at this landscape position with a small lagoon discharging to the ocean?
2. What is the potential effect of using the Meyer-Peter and Muller (MPM) equation rather than other analytical solutions that might be more appropriate?
3. What is the basis for the recurrence intervals selected for different design reaches?
4. We understand that a reference reach for the GGNRA restoration project of the Banducci site, approximately 1 mile above the Big Lagoon Project site, has been determined to have a bankfull channel of approximately 35 feet. The drainage area at the Project site is larger than the Banducci reference site. What is the bankfull width of the restored stream? How have bankfull width and other design parameters (slope, width, depth, sinuosity) been determined and found to be appropriate for use in an alluvial reach that transitions into an estuarine reach, and at this landscape position with a small lagoon discharging to the ocean? If this detailed information is to be developed and refined at the next design phase, then it is important to identify if any of these design parameters (e.g., stream width) have outside constraints that might affect flexibility of the design. F-12
5. Figure 4.3.1-1 depicts the lowering of the thalweg elevation from its current elevation by up to four feet. Is the lowering of the thalweg related to relocating the channel to the lowest elevation in valley, or because the channel is being deepened?

Sea Level Rise (p. 4-36)

There are many aspects of the Project that may be affected by sea level rise. We realize that the DEIR/S was prepared based on the best information available at the time; however, the new Intergovernmental Panel on Climate Control (IPCC) report issued in early 2007 has provided new information on sea level rise. Project planning should consider these revised estimates and propose mitigating measures where necessary. F-13

Soil Disposal- impacts to water tank

It is our understanding that the preferred alternative for soil disposal is also one of the few available sites for a new water tank for the Muir Beach community. While this is not currently planned, increased water storage to reduce the need for summer withdrawal is an essential component of a restored watershed, and potential impacts to this site must be considered. For example, mitigations such as adequate soil compaction and provision of adequate space need to be included in the Project plan. F-14

Maintenance (p. 4-33, Impact WP-R9)

With the substitution of the longer bridge alternative, we believe this Project can improve the ecosystem and

natural creek functions in the Project area. However, as noted above, due to large annual and episodic sediment and LWD/debris loads and the ongoing potential for channel avulsion, the Project will likely experience ongoing adjustments. It is critical that these adjustments be allowed to occur without maintenance intervention unless it is demonstrated to be necessary for the success of the restoration. This is particularly critical in the area below the Pacific Way bridge. The DEIR/S language states that "maintenance could be indicated if sediment deposition or changes in the channel form pose flooding threats to structures in the floodplain or otherwise resulted in undesirable conditions". The criteria under which maintenance would be proposed need to be clarified and mitigation measures proposed, including consideration of prohibition of maintenance below Pacific Way bridge except to further restoration goals. F-15

Construction Phasing

• Issues to be addressed (p. ES-29) notes the possibility that the replacement of the Pacific Way bridge might be delayed until after the completion of the restoration Project below the bridge; this would also delay the upstream restoration of the new channel above the bridge. We believe this could have significant adverse impacts and every effort should be made to construct the bridge prior to or concurrent with the channel realignment. There is no explanation in the DEIR/S of what the "temporary channel alignment" would entail. This issue needs to be addressed as part of the DEIR/S. The bridge replacement is an integral component of this Project, and its design, construction timing, and funding must be clearly identified. F-16

• Impact WQ-R3 (p. 4-53) states that "short duration pulses of sediment would be expected during storm events occurring in the first rainy season following construction". It should be noted that we expect as part of the SWPPP that post-construction BMPs should prevent such sediment discharges throughout the proposed 3 to 4 year construction period. Of particular importance would be winterization measures to prevent discharge of sediment and other contaminants during the rainy season. F-17

• While we understand that impacts to vegetation are unavoidable during the construction phase, every effort should be made to minimize and mitigate for these impacts, including an active revegetation component. F-18

Pedestrian Access and Parking

• We support the plan provisions for pedestrian access that predominantly keep the access to the perimeter of the site and provide maximum habitat protection. This support is conditioned on our understanding that development of pedestrian trails will not require excessive tree removal. F-19

• We believe the proposed parking lot alternative to reconfigure the parking lot but keep it at its current capacity will minimize impacts to wetlands and the creek. However, this alternative could be improved by substituting some parking spaces with a small drop-off area for a small bus, while maintaining the same sized parking lot. F-20

Watershed Sediment Reduction Activities

In the public meeting forums, we have suggested a "two-phased program" in which the Big Lagoon Project would be designed and implemented in the first phase. In the second phase other watershed projects would be identified that would not be funded directly with this Project but should be pursued since they would greatly enhance the success of the Big Lagoon Project. We think watershed sediment reduction from roads and trails (and other sources) should be explicitly incorporated and tied to this Project as a second phase, with high priority for future funding. F-21

Thank you for considering these comments. If you have any questions, please call Leslie Ferguson at (510) 622-2344, email lferguson@waterboards.ca.gov or Dale Hopkins at (510) 622-2362, email dhopkins@waterboards.ca.gov.

Sincerely yours,

original signed by

Wil K. Bruhns,
Division Chief, North Bay Watershed

Cc: Carolyn Shoulders, GGNRA
Darren Fong, GGNRA

Letter F: San Francisco Bay Regional Water Quality Control Board (March 6, 2007)

Response to Comment F-1

Please review MR-1. The preferred alternative has been changed to BR4, which is the longest possible Bridge Alternative.

Response to Comment F-2

Please refer to MR-2, which discusses the bridge design and issues such as floodplain connectivity, natural channel function, and channel migration. Note that NPS and the County now have chosen to select the longest bridge possible to maximize the benefits associated with these factors.

Response to Comment F-3

NPS and Marin County agree that the longest bridge provides the most protection against the uncertainties in flood elevations related to sea level rise, and this is one reason that Marin County has changed its preferred bridge alternative to BR4, the longest bridge alternative, as discussed in MR-1 on page 6-3. Since it is the longest feasible bridge, given constraints with the Pelican Inn on one end of the road and a residential driveway at the other, it will arguably provide the highest level of protection for vehicular access, flood reduction, and natural channel function no matter what the future scenario is. Please refer to MR-3 for a more complete discussion of the effects of sea level rise.

Response to Comments F-4 and F-5

The combined benefits of the longest possible bridge, the parking lot rotated away from the floodplain, removing the levee, and returning the channel to the center of the floodplain are expected to create the optimal conditions for natural sediment movement at the site. Some sediment deposition will occur in the vicinity of the Pacific Way bridge, with or without the project. However, as with sea level rise, the longest possible bridge provides the greatest protection against uncertainties and unpredictability in sediment deposition and its potential effects on flood elevations in the vicinity of Pacific Way.

Despite the sediment transport modeling results (Appendix D), we expect that the project will result in less overall sediment deposition than under existing conditions since the potential obstacles from infrastructure will be as minimal as possible. Furthermore, we expect that the new bridge configuration, with the larger channel opening, will be more resilient to sediment deposition and will

reduce flood hazard risk to existing structures compared with the current bridge configuration and sediment regime.

Project goals include restoring a "self-sustaining ecosystem" that "functions in the context of the watershed and other regional boundaries." The project location is in the downstream-most reach of Redwood Creek, which has historically been depositional because of decreased channel gradient and tidal effects. The main objectives of reducing deposition are (a) to not increase flooding of Pacific Way or nearby structures, and (b) to not block or otherwise modify the creek channel in a manner that would be detrimental to fish passage or winter rearing habitat.

The restoration design was developed to decrease local sediment deposition as much as is practicable, given site constraints, and to reduce the need for mechanical sediment removal (i.e., maintenance dredging). While we cannot guarantee that dredging will not be required, the following project elements should reduce the likelihood and/or frequency of dredging:

- relocating the channel to the valley low spot to improve flow concentration (i.e., reduce flow bifurcation) and sediment transport capacity, as well as to increase floodplain sediment storage potential;
- grading the relocated channel to have as uniform a slope (and sediment transport capacity) as possible, consistent with the valley floor slope, to reduce the potential for local sediment deposition around sharp gradient breaks; and
- replacing the existing 25-foot span Pacific Way bridge with a 250-foot-long and higher bridge, aligned with flow direction, to reduce the existing hydraulic constraint at Pacific Way.

It should be noted that increased sediment deposition may occur farther downstream—for example, where the channel is downsized to increase out-of-bank flooding (to benefit coho salmon rearing). However, sedimentation at these locations is not expected to increase flood hazards or necessitate maintenance dredging.

Response to Comment F-6

The RWQCB's comments regarding the environmental detriments of a short bridge are noted. As part of the environmental review and public comment process for this project, NPS will continue to weigh all appropriate commentary regarding alternative components of the project prior to their decision on implementation. Also, as noted above, the preferred alternative has been changed to BR-4, the longest bridge. See also MR-1.

Response to Comment F-7

The longest possible bridge is, in essence, a causeway that will appear to be similar in elevation or slightly higher than the road at either end. The elevation of Hwy 1 is 16.5 feet NGVD; the height of the bridge under Alternative BR4 would be somewhere between 16.25 and 18 feet (final height would be determined during project design). For comparison, the height of the existing bridge is 15.2 feet NGVD, 1.3 feet lower than the elevation of Hwy 1.

Marin County will reduce the maximum possible width from 36 feet to 32 feet, with the specific width to be determined during the design phase. The 32-foot width, as with the prior 36-foot width, is intended as a maximum width for purposes of analysis in the EIS/EIR. Marin County does not want to overly constrain designers at this stage. The 32-foot bridge width allows for two vehicle lanes (each 10 to 11 feet wide), a shoulder on each side of about a foot, and a 6-foot-wide pedestrian path. It may be possible to reduce the width to less than 32 feet during design, but this reduction cannot be committed to without designs.

A separate bridge for pedestrian access was not considered further because it not only would be significantly more expensive but also would be likely to have additional aesthetics impacts to the natural area.

Please also refer to MR-1.

Response to Comment F-8

Since the longest bridge alternative has been selected as the Preferred Bridge Alternative, any potential visual effect of the embankments next to a raised road has been minimized. A longer bridge means that there is less length of the road that must be raised, and therefore less area will be covered in new embankments next to the road.

We agree that the embankments would have a visual effect, and, extending up to 10 feet next to the road at the points where the road is highest, they could be more obtrusive visually than the natural area that would be next to the longer bridge. However, given that the most frequent views of the bridge would be from Hwy 1 or from along Pacific Way, the embankments are not as important to the visual experience of the bridge as its overall height and width—which are anticipated to be the primary factors affecting the view from these vantage points. While the comment is noted and appreciated, it does not change the overall evaluation of aesthetics impacts presented in the EIS/EIR.

Response to Comment F-9

Please refer to MR-2.

Response to Comment F-10

As discussed on pages 3-22 and 3-23 in Section 3.1.2, *Water Quality*, diurnal fluctuations in dissolved oxygen levels could occur during low-flow periods under existing conditions. Although these conditions may contribute to exceedance of water quality standards, the proposed project is expected to improve dissolved oxygen conditions overall compared to existing conditions as riparian vegetation matures and reduces the aquatic plant and algal growth that contribute to diurnal fluctuations and biological oxygen demand. We acknowledge that backwater areas may still have lower dissolved oxygen levels than the adjacent main channel. However, these backwater areas are important biological features.

Please refer to Impact WQ-R6, which discusses the impact of increased nutrients, lowered DO levels and nuisance plant growth during low-flow periods and during various stages of wetland development. This impact discussion applies to all aspects of the proposed water features as proposed, including the creek channel, backwater channels, and lagoons. While the Draft EIS/EIR adequately addressed these effects on water quality, text has been added to the Final EIS/EIR to clarify the discussion of Restoration Alternative 2 in Impact WQ-R6.

Response to Comment F-11

The proposed project increases the tidal lagoon's ability to expand by removing wetland vegetation along its landward edge. An approximately 100-foot-wide band of vegetation would be removed (for a total excavation volume of 80,000 cubic feet or 3,000 cubic yards). Proposed changes to the tidal lagoon are expected to increase the surface area of the lagoon and consequently its total volume. However, because of the limited size of the change, we do not expect the timing of lagoon opening and closures to be significantly modified by the project, as described further below.

It should be noted that since the Feasibility Analysis was completed in 2004, the tidal lagoon and upstream channel has enlarged on its own during large storms, most notably the December 31, 2005, event. Therefore, mechanical enlargement of the tidal lagoon may not be needed; however, this proposed action is included in the EIS/EIR to allow further consideration during the design phase.

Breaching/Opening Mechanics

Natural reopening of a closed inlet occurs when the water level on one side of the beach barrier exceeds the elevation of the beach crest. This can occur either when high runoff fills the lagoon or when high storm surge tides occur. After the lagoon fills, the ebbing tide allows discharge from the lagoon by scouring a channel at the lowest point on the beach barrier. This breaching mechanism is affected by the wave run-up, the storm surge, the antecedent topography of the beach barrier, and the storage capacity of the lagoon.

Enlarging the tidal lagoon could potentially have the potential to delay lagoon opening if (a) the water surface were decreased because of increased storage volume (taking longer for the lagoon to fill to a critical elevation), or (b) losses from seepage or evaporation were increased. However, based on our evaluation of these two conditions (as described below), changes to the timing of lagoon opening is not likely.

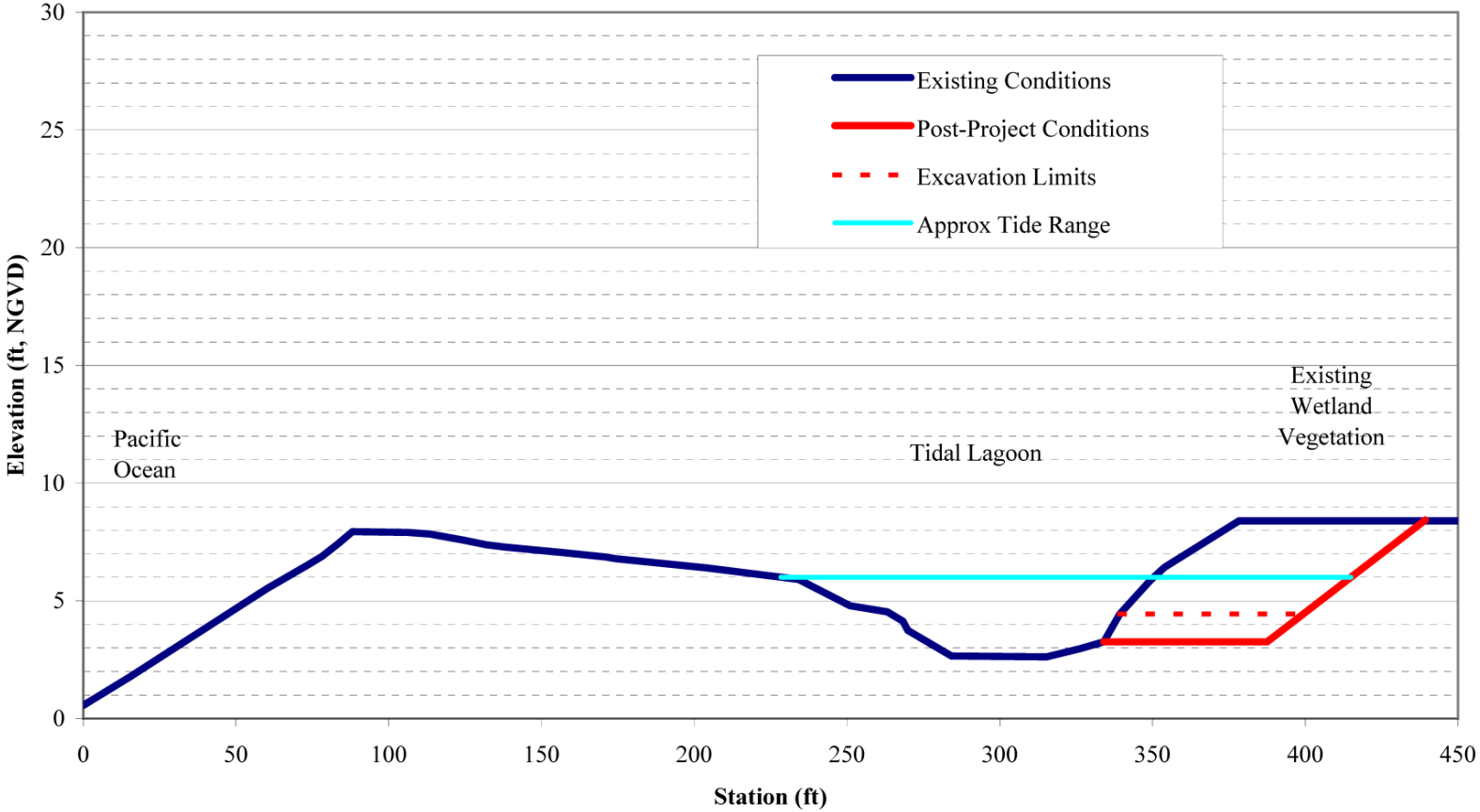
We quantified the expected volume change to evaluate its potential to affect the timing of lagoon opening. The additional storage volume was estimated as approximately 4,000 cubic yards, based on the excavation volume plus expected scour (see Figure 6-4 for a schematic showing the lagoon cross-section). Assuming a constant base flow of 0.5 cfs (based on typical flows during the months of October and November), this additional lagoon volume will fill in less than 3 days. During a storm event, the additional lagoon volume would fill much faster (e.g., a 10 cfs inflow would fill this additional lagoon volume in 3 hours).

Seepage losses to the beach are not expected to increase under the proposed project because the tidal lagoon configuration along its beachward edge will not be modified. Evaporation losses from the lagoon are not expected to significantly increase under the proposed project. Total evaporation loss is roughly estimated at 0.1–0.3 inch per day (Kohler et al. 1959, as referred to in Dunne and Leopold 1978); a 0.5-cfs base flow would replenish lagoon water levels by 6 to 12 inches daily.

Closure Mechanics

The ability of an inlet to remain open is primarily a function of the scouring effect of tidal currents and stream flow and the amount of sediment deposited in its entrance as a result of wave-induced sand transport. An inlet will close if ebb currents in the channel are not sufficiently strong to scour away material previously deposited during the flood tide. Closure usually occurs during neap tides, when the ebb scour potential along the channel is at a minimum and at times of low stream flow and high swell activity.

Increasing the tidal prism (the total volume of tidal waters exchanged during one tide cycle) has the potential to prolong the time the lagoon mouth stays open once it has been breached. Because the tidal lagoon size is quite dynamic, changing seasonally and annually, the total change in tidal prism attributable to the project will vary over time. For discussion purposes, we have estimated that the proposed project could increase the tidal prism by 30% in the winter, assuming a uniform lagoon cross-section as shown in Figure 1 and a 3-foot maximum tidal range (PWA 2004, Figure 1). Analysis of tidal inlets along coastal California suggests that a change of this magnitude would not significantly affect the existing pattern of seasonal closure (Johnson 1973). Even doubling the size of the tidal prism (100% increase) would have little impact on closure frequency (PWA 1994). In general, we expect the larger tidal prism of the lagoon to maintain a slightly larger (deeper) entrance channel during open periods. However, the pattern of seasonal closure is expected to persist.



Based on cross-section R from the 2003 EDS ground survey, modified to reflect the relatively flat wetland area approx 100 feet upstream.
Estimated tide range based on maximum tide range of approximately 3 feet (PWA, 2004), assuming beach configuration at the time of the 2003 ground survey.

05052.05 (8-07)

Jones & Stokes

Figure 6-4
Schematic Cross-Section of Tidal Lagoon

Exhibit 2: Final Environmental Impact Statement

Response to Comment F-12

This response addresses the following four questions.

1. Is SAM appropriate for this location in the watershed that transitions from an alluvial reach to an estuarine reach?

SAM, the USACE's Stable Channel Analytical Model, can be used to evaluate slope-depth-width combinations to understand a channel's ability to carry its load in any region of the watershed; as such, it is appropriate for use in the reach under consideration in this project. For Redwood Creek, the SAM analysis was one of multiple methods used to help answer the question of whether the creek system would be at risk of incising (PWA 2004). Our conclusion that the system would tend to be depositional or in equilibrium, rather than erosional, was based on multiple lines of evidence:

- The existing channel is depositional based on the sediment accumulation measured over the past several years; this is consistent with its location in the lower watershed.
- The gradient of the new design channel (approximately 0.3%) will be less than the valley slope (approximately 0.4%) and the upslope contributing reach.
- The proposed channel gradient correlated with equilibrium gradients of similar streams surveyed in Contra Costa County, taking into account differences in bed material (PWA 2004).

The SAM model was then used as an additional line of evidence to verify that the design channel was not expected to be erosional. The SAM model was not used to determine channel dimensions; rather, preliminary design channel dimensions were used as input values in the model. A more complete analytical approach, as described under the response to Question 4 below, is recommended to determine final channel sizing.

2. What is the potential effect of using Meyer-Peter and Muller, rather than Parker (or other equation)?

The sediment transport modeling was one of several lines of evidence used to assess stream stability, and we therefore looked to see if the most easily implemented sediment transport tools were effective before conduct a wider search of different models. Our approach (which PWA has used on several other studies) was as follows:

1. Use Reid and Dunne's 1996 evaluation of different sediment transport equations to select a range of appropriate candidate sediment transport equations for the field site.

2. Test the best candidate equations from Reid and Dunne against observed field data (Stillwater Sciences, 2004) until a model was found that fitted the data closely (i.e. agreement between predicted and observed sediment loads). This test was carried out in order of ease of use (i.e. we tested the most easily implemented models first).

The Reid and Dunne study (1996) reviewed the accuracy of various sediment transport equations in real-world applications (i.e. in natural rivers rather than flumes) [10]. While both the Parker and MPM equations are appropriate for gravel-bedded streams, the Parker equation initially appeared to be a more accurate predictor for small streams based on a limited sample size (only 3). In three case studies using the MPM equation, sediment capacity was underestimated by 2 times or more (>200%), while the three tests of the Parker model were within 200% of the measured load. These theoretical results from the Reid and Dunne study were the basis for referring to the Parker equation in PWA (2004) and the DEIR/EIS.

The MPM equation (rather than the Parker equation) was initially selected for the SAM analysis because it was the most applicable equation available in the current version of the SAM model (the Parker equation is not available in the version of SAM used in this study, although it can be found in other, more complex sediment transport packages). The modeling results using MPM were compared to measured sediment data for Redwood Creek (Stillwater Sciences, 2004). The measured value was in close agreement with the predicted values from the MPM equation (530 mg/L versus 510 mg/L, PWA, 2004). In sediment transport modeling a difference between predicted and observed results of 4% is considered exceptionally good; for example, the Reid and Dunne book considered any results within 200% of the predicted results to be relatively successful. Therefore, based on the close correlation between predicted and observed results, we believe that the MPM equation is the best predictor for evaluating sediment transport on Redwood Creek. Given the close agreement and the ease of application of MPM it was not necessary to explore the use of the Parker equation or other equations in more complex sediment transport modeling tools.

3. What was the basis for the recurrence intervals selected for different design reaches?

For the SAM analysis, the 1.5-year storm (as estimated from previous annual flood frequency analysis [PWA 1998]) was selected to represent the bank full flow event. This selection was based on the accepted practice of using the 1.5-year storm as an estimate of the bank full (or channel-forming) event (Leopold et al. 1964). See the response to Question 4 below for proposed future actions to

[10] For Redwood Creek, there are only five equations that have been tested for similar small gravel-bedded channels: Diplas, Einstein/bedload, Meyer-Peter/Muller, Parker and Schoklitsch/1943 (Reid and Dunne, 1996, Table 9).

refine the quantification of the bank full (or channel-forming) event to be used in channel sizing.

4. What is the basis for design channel dimensions?

The preliminary design dimensions of the low flow channel were selected to allow hydraulic modeling of the preferred alternative. The channel dimensions are first based on existing channel dimensions of Redwood Creek approximately 0.5 to 1 mile upstream at the Banducci site. During the detailed design phase, the following additional analysis will be performed to refine channel dimensions.

- Historic flow data will be analyzed to better quantify the frequency of smaller high flow events (e.g. the 1- and 1.5-year events). The *Redwood Creek Feasibility Report* (PWA 1998) included a flood-frequency analysis for the 2- to 100-year events, and the *Big Lagoon Feasibility Report Addendum* (PWA 2004) includes analysis of 1999 to 2003 high flow data. During the detailed design, the analysis of high flow data would be expanded to include all data available at that time.
- The bank full flow will be selected for different channel reaches. In the upstream portion of the project site (e.g., upstream of Pacific Way), the 1.5- to 2-year event likely will be used for channel sizing. Downstream of Pacific Way, a smaller flow will be selected to increase the frequency of out-of-bank flows to maximize ecosystem restoration. Selection of appropriate design flows will be based in part on further identification and analysis of stable reference reaches within the watershed.
- A suitable range for channel equilibrium slope will be determined using a variety of empirical and analytical methods. The channel planform (i.e., sinuosity) can be modulated, as practical, to achieve a channel gradient that is considered stable. However, the channel gradient also will be dictated by the existing constraints to channel location (e.g., property lines, Pacific Way, etc.)
- Upon final selection of the channel location and gradient, low flow dimensions will be refined. This refinement may include varying channel dimensions at outside meander bends, etc. Selection of low flow channel dimensions will be based on local hydraulic geometry relationships, measurements of reference reaches, and hydraulic analysis. There are no apparent constraints on channel depth or top width; the height of the low flow berms can be adjusted as needed to achieve the desired channel depth while maintaining a uniform channel gradient.

5. Is the thalweg elevation (the channel low point) lowered because it will be in a lower elevation in the valley or because the channel is being deepened?

Figure 4.3.1-1 shows that channel for the preferred alternative will be excavated with a relatively uniform gradient from the upstream to downstream project

boundary. As shown in Figure 4.3.1-1, the proposed thalweg may be up to 4 feet below the existing thalweg in some locations where the channel has aggraded as a result of high sediment deposition. Therefore, the new channel will deeper than the aggraded reaches of the existing channel.Overall, the proposed channel will have approximately the same gradient as the existing channel between the project limits.

Response to Comment F-13

The latest IPCC (2007) predictions for future global sea-level rise over the next 50 years are lower than those estimated in IPCC (2001); therefore, the analysis in the Draft EIS/EIR is conservative, and no additional mitigation measures are necessary. Please also refer to MR-3, which provides a complete discussion of sea level rise and the newer revised estimates, including the implications of sea level rise over a 100-year time frame and longer.

Response to Comment F-14

Comment noted. The Big Lagoon project is not incompatible with potential placement of a water storage tank. Placement of fill at the old reservoir pit does not preclude the possibility of placing a new water storage tank there for the MBCSD. NPS recognizes the importance to MBCSD of obtaining a new water storage tank so that impacts to federally listed salmonids can be avoided or reduced during periods of low flows in the creek. With a larger water tank, MBCSD would not have to pump as much water during the low-flow periods, and creek flows during critical periods can be better maintained. NPS is willing to work with MBCSD to site a new storage tank in the fill placement area or other possible areas on NPS lands in order to protect the habitat for salmonids. There are many ways a tank and fill could be configured for good placement at the unused reservoir. There are no additional impacts associated with use of the unused reservoir for soil disposal that were not disclosed in the Draft EIS/EIR, and no additional mitigation is necessary.

Response to Comment F-15

It is the full intent of NPS and Marin County to allow natural channel processes to occur and not to conduct routine maintenance related to deposited sediment or channel form. It is unlikely that maintenance actions related to channel form would be conducted downstream of Pacific Way, except to further restoration goals, because the channel will have broad latitude for natural reconfiguration in that area.

That said, the proposed restoration actions do not fundamentally alter the range of flooding conditions that could occur during large storm events or other aberrant catastrophes. If conditions resulting from a large event, series of large events, or catastrophic event clearly threaten structures or health and safety—and

maintenance actions would be likely to provide relief—maintenance actions would likely be taken as necessary to protect safety while also considering and minimizing the ecological impacts of such actions. Any such actions would be subject to regulatory review and permitting, and any necessary maintenance will comply with all relevant regulations. Neither NPS nor the County seeks explicit regulatory authority for maintenance actions as part of this project.

Response to Comment F-16

It is preferable for the County to construct the bridge concurrently with the rest of the project and in advance of downstream actions, if possible. However, since it may be possible that funding for the bridge will lag behind available funding for other actions, the EIS/EIR was written to allow for construction of the bridge following the implementation of actions downstream of the bridge. It is anticipated that if the bridge is built after the downstream actions, it would be constructed at the end of the 2- or 3-year construction period, and not substantially later than other actions. If the bridge is built after the downstream actions are implemented, a temporary channel would be constructed from the existing Pacific Way bridge to the new channel. The channel upstream of Pacific Way would not be relocated until the new bridge was constructed. A temporary channel would be designed to provide sufficient flow conveyance capacity between the existing (upstream) channel and the realigned (downstream) channel and allow channel function that is at least commensurate with existing conditions. As such, it would not exhibit characteristics that are fundamentally different from those associated with the project at large. Other potential impacts have been disclosed in the Draft EIS/EIR and are identical to those associated with all the realigned channels. They include:

- short-term increases in turbidity, nutrients, and temperature in the creek following construction, which would be mitigated through Mitigation Measures WQ-MM-3 (Turbidity Monitoring and Response Plan), WQ-MM-4 (Water Quality Monitoring and Response Plan), and FISH-MM-1 (Riparian Shade Mitigation and Monitoring);
- generation of construction-related pollutant emissions, which would be mitigated by Mitigation Measures AIR-MM-1 (implementation of BAAQMD Dust Control Measures) and AIR-MM-2 (Measures to Reduce NO_X Emissions from Diesel-Powered Equipment);
- temporary disturbance to vegetation communities, which would be minimized to the greatest extent practicable;
- temporary disturbance to common species of wildlife;
- minor short-term adverse effects to juvenile salmonid rearing habitat;
- potential for disturbance of previously unidentified cultural resources, which would be addressed by Mitigation Measure CR-MM-1 (Contingency Measures for Such Discovery);

- reductions in recreational opportunities and aesthetics during construction and site establishment;
- minor effects to visitor safety, which would be addressed by Mitigation Measures REC-MM-1 (Construction Exclusion Areas) and REC-MM-2 (Horse and Equestrian Safety Measures);
- traffic effects of construction, which would be minimized through implementation of Mitigation Measure TC-MM-1 (Construction Traffic Management Plan);
- energy use and use of nonrenewable resources for construction; and
- construction noise, which would be minimized through Mitigation Measures NZ-MM-1 (Noise-Reducing Construction Practices), NZ-MM-2 (Noise Control Plan), and NZ-MM-3 (Public Information Measures).

Response to Comment F-17

Construction and post-construction BMPs, including winterization measures, will be implemented to protect water quality, as will be outlined in a SWPPP. However, some pulse of sediment following construction is likely to be unavoidable as the restored site establishes, particularly sediment originating from within the newly established creek channels themselves.

Response to Comment F-18

Comment noted. Active revegetation is a part of the proposed project. NPS will develop a detailed revegetation strategy as part of the preparation of project designs. The revegetation strategy will identify the target species composition for the site's microhabitats and methods for achieving the target composition through a combination of planting nursery stock, removing nonnative vegetation, and relying on natural recruitment where it is likely to be fast enough to make outplanting unnecessary. In some cases, native vegetation, such as rushes, that is excavated may be suitable for replacement on the finish grade. Specific needs, such as rapid establishment of shade over the new channel, will be factored into the revegetation strategy. NPS works with the Golden Gate National Parks Conservancy to operate the Redwood Creek Native Plant Nursery, located near Muir Woods National Monument, which will be engaged in onsite revegetation in this project. NPS will work with volunteers to collect propagules from the local watershed, grow nursery stock, and plant nursery stock on site.

Response to Comment F-19

Comment noted. Tree removal for project implementation will be minimized to the greatest extent practicable.

Response to Comment F-20

As discussed in the response to Comment J-1, the County is not currently providing bus service to Muir Beach; the Stage Coach service that formerly accessed Muir Beach via Shoreline Highway has been rerouted because of low ridership, and there is no immediate plan to return bus service to the beach. At the same time, EIS/EIR analysis has shown that reduced parking without transit service would result in unacceptable impacts to local traffic circulation. At the present time, sacrificing parking space to provide access for bus service that is not assured would create substantial detriments without providing a meaningful benefit. Nonetheless, as identified previously, NPS is committed to continued coordination with County transit providers to improve transit access to Muir Beach. If bus service to the Muir Beach area is reinstated in the future with a drop-off at the beach, it would be possible accommodate bus access to the beach with minimal modifications to facilities installed under the proposed action.

Response to Comment F-21

Additional actions to reduce sediment inputs to the system are needed in this watershed, but these actions are not a part of this project. Land managers for the publicly owned watershed lands—NPS, State Parks, Marin County, and the MMWD—have developed a greater awareness of sediment delivery from roads, road-runoff, trails, undersized culverts, former land modifications for agriculture, and numerous other land uses. Each agency has conducted one or more actions in recent years that will reduce sediment inputs. For instance, in 2007, the Marin Municipal Water District completed road-related erosion control measures at 14 sites in the upper Redwood Creek Watershed, including Old Railroad Grade and Gravity Car Road, to prevent an estimated 5,100 cubic yards of sediment from entering Redwood Creek. MMWD has previously recontoured trails and stream crossings in the upper watershed to reduce erosion. NPS's expansion of the active floodplain at the Banducci Site in 2003 2007 (Lower Redwood Creek Floodplain and Salmonid Habitat Restoration at the Banducci Site) adds areas for natural sediment deposition. In 2003, NPS also recontoured an old road and blown out culvert at a stream crossing on a steep hillside behind Muir Woods National Monument to prevent slope failure and the delivery of an estimated 900 cubic yards of sediment that could have reached the creek. Marin County has installed fences along roadside parking areas near Muir Woods to reduce sedimentation to the creek from those areas. State Parks has replaced undersized culverts, and trail recontouring proposed at Dias Ridge will reduce sediment runoff (see also the list of cumulative actions presented in the Draft EIS/EIR). Additional proposed actions would be expected in the future as part of a comprehensive watershed management plan, but they should not be considered part of the specific project under review in this EIS/EIR.

G

STATE OF CALIFORNIA
Governor's Office of Planning and Research
State Clearinghouse and Planning Unit

Arnold Schwarzenegger
Governor

Cynthia Bryant
Director

February 6, 2007

Tim Haddad
Marin County Community Development Agency
3501 Civic Center Drive, Room 308
San Rafael, CA 94903

Subject: Wetland and Creek Restoration at Big Lagoon, Muir Beach, Marin County
SCH#: 2004042143

Dear Tim Haddad:

The State Clearinghouse submitted the above named Joint Document to selected state agencies for review. The review period closed on February 5, 2007, and no state agencies submitted comments by that date. This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. G-1

Please call the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process. If you have a question about the above-named project, please refer to the ten-digit State Clearinghouse number when contacting this office.

Sincerely,

Terry Roberts

Terry Roberts
Director, State Clearinghouse

1400 TENTH STREET P.O. BOX 3044 SACRAMENTO, CALIFORNIA 95812-3044
TEL (916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

Document Details Report
State Clearinghouse Data Base

SCH# 2004042143
Project Title Wetland and Creek Restoration at Big Lagoon, Muir Beach, Marin County
Lead Agency Marin County

Type JD Joint Document

Description This Draft EIS/EIR presents and evaluates alternatives to restore a functional, self-sustaining ecosystem, and provide for public access that is compatible with restoration. The 38-acre project site is located entirely within the boundaries of the Golden Gate National Recreation Area, but includes some properties owned by the San Francisco Zen Center and Marin County. This Draft EIS/EIR analyzes three Restoration Alternatives, six Public Access Alternatives, four Bridge Alternatives, and five Fill Disposal Alternatives.

Lead Agency Contact

Name Tim Haddad
Agency Marin County Community Development Agency
Phone (415) 499-6274 **Fax**
email
Address 3501 Civic Center Drive, Room 308
City San Rafael **State** CA **Zip** 94903

Project Location

County Marin
City
Region
Cross Streets Pacific Way and Highway 1
Parcel No. 199-16-14, 15, 17, 18, 19, 21, 22, 24
Township **Range** **Section** **Base** MD

Proximity to:

Highways One
Airports
Railways
Waterways Redwood Creek
Schools
Land Use Coastal Open Space (C-OS) and Coastal Agriculture (C-AG1)

Project Issues Aesthetic/Visual; Agricultural Land; Air Quality; Archaeologic-Historic; Biological Resources; Coastal Zone; Cumulative Effects; Drainage/Absorption; Economics/Jobs; Flood Plain/Flooding; Geologic/Seismic; Growth Inducing; Landuse; Noise; Population/Housing Balance; Public Services; Recreation/Parks; Septic System; Soil Erosion/Compaction/Grading; Solid Waste; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wetland/Riparian; Wildlife

Reviewing Agencies Resources Agency; Regional Water Quality Control Board, Region 2; Department of Parks and Recreation; Native American Heritage Commission; Department of Fish and Game, Region 3; Department of Water Resources; California Coastal Commission; California Highway Patrol; Caltrans, District 4; Department of Toxic Substances Control; State Lands Commission

Date Received 12/22/2006 **Start of Review** 12/22/2006 **End of Review** 02/05/2007

Note: Blanks in data fields result from insufficient information provided by lead agency.

Letter G: California State Clearinghouse and Planning Unit (February 6, 2007)

Response to Comment G-1

Comment noted. Note that consistent with NPS NEPA requirements, the comment period was extended through March 6, 2007.

H

MARIN MUNICIPAL WATER DISTRICT

RECEIVED

2006 JAN -8 P 2:43

MARIN COUNTY
COMMUNITY DEVELOPMENT

220 Nellen Avenue Corte Madera CA 94925-1169
www.marinwater.org

December 29, 2006
File No. 249.1

Tim Haddad
Marin County Planning Department
3501 Civic Center Drive #308
San Rafael CA 94903-4157

RE: **WATER AVAILABILITY** – Big Lagoon Restoration
Assessor's Parcel No.: 199-160-14, -15, -17, -18, -19, -21, -22, and -24
Location: Pacific Wy. and Hwy. 1, Muir Beach

Dear Mr. Haddad:

The above referenced parcels are located outside of the Marin Municipal Water District's current service area.

If you have any questions regarding this matter, please contact me at (415) 945-1531. H-1

Very truly yours,

Joseph Eischens
Project Manager

JE:dh F:\ENGINEER\WP\LETTERS\Ltrs-2006\Ltrs-Dec\je-12-29-06a-dh.doc

recycled recyclable

Letter H: Marin Municipal Water District (December 29, 2006)

Response to Comment H-1

Comment noted. Thank you for taking the time to review the project and participate in the environmental review process.

I

Steve Ortega
03/13/2007 09:54 AM PDT

To: Karen Cantwell/GOGA/NPS@NPS, Ann Dolmage/GOGA/NPS@NPS
cc:
Subject: Fw: From NPS.gov: Just in case the regular website comments fail - Big Lagoon Comment

----- Forwarded by Steve Ortega/GOGA/NPS on 03/13/2007 09:54 AM -----

Steve Ortega
03/11/2007 11:06 AM PDT

To: MStevenson@jsanet.com
cc: Carolyn Shoulders/GOGA/NPS@NPS
Subject: Fw: From NPS.gov: Just in case the regular website comments fail - Big Lagoon Comment

Comment submitted on goga_planning@nps.gov

Steve O.
----- Forwarded by Steve Ortega/GOGA/NPS on 03/11/2007 11:05 AM -----

Nancy Hornor
03/10/2007 03:56 PM PST

To: Steve Ortega
cc:
Subject: Fw: From NPS.gov: Just in case the regular website comments fail - Big Lagoon Comment

Nancy Hornor
Planning Division Chief
Golden Gate National Recreation Area
(415)561-4937
----- Forwarded by Nancy Hornor/GOGA/NPS on 03/10/2007 04:02 PM -----

eac@svn.net
03/06/2007 07:32 PM EST

To: GOGA_planning@nps.gov
cc:
Subject: From NPS.gov: Just in case the regular website comments fail

Email submitted from: /goga/parkmgmt/biglagoon.htm

Hi,

These are comments on the Big Lagoon Restoration (below). I am sending them here as well, because my comments once ran into glitches on a different project, so I wanted to be redundant just in case. Thanks

Fred

March 6, 2007

Brian O'Neill, Superintendent Golden Gate National Recreation Area

Re: Big Lagoon/Redwood Creek Restoration

Dear Superintendent O'Neill,

Thank you for the opportunity to comment on the Wetland and Creek Restoration at Big Lagoon

Draft Environmental Impact Statement/Environmental Impact Report (DEIS/R). I am writing on behalf of the Environmental Action Committee of West Marin (EAC), representing close to 1000 members. While the EAC feels that many of the substantive issues have been addressed since GGNRA originally proposed this project, we think that the bridge option BR3 in GGNRA's preferred alternative is not the best option from a cost-benefit standpoint, especially if GGNRA makes realistic assumptions prior to comparing the alternatives.

First, the cost benefit analysis of the bridge alternatives is unrealistic. Not only does it state that the bridge will likely be less wide than the analysis width of 36 feet, but the length of the bridge analyzed in BR4 is in excess of 275 feet (2-24) which is unrealistic with regard to topography and floodplain width. In other words, GGNRA has likely overestimated the cost of BR4, despite the fact that it is the option with the best potential to restore natural watershed processes and minimize bridge/road flooding. In the Final Environmental Impact Statement/Report (FEIS/R), please analyze a new bridge option that provides a realistic cost-benefit analysis of a slimmed down, realistic-length BR4 based upon the actual dimensions required to span the floodplain. Also, focus the analysis not only on realistic bridge dimensions but also on ways that BR4, since it is the best for the environment and flooding, could be more cost effective and financially palatable. Only then can GGNRA do a fair cost-benefit analysis between BR3 and BR4. I-1

Second, GGNRA's analysis of the bridge alternatives does not adequately account for greater than a .7-foot sea level rise and the potential for increased intense, acute flooding events due to global warming. Ideally the goal of this project is to provide a long-term solution for creek restoration and public safety. Please analyze the effect of a 1+ meter sea level rise and increased flood event frequency that could occur due to global warming on the bridge and watershed models in the FEIS/R. This will ensure that the Preferred Alternative is adequate for a full range of global warming scenarios, especially considering that we know that BR4 provides the most benefits regardless of cost. I-2

The ecological benefits provided by BR4 are vitally important to restoring natural ecological process to the entire Redwood Creek watershed, including areas upstream. BR4, which provides the greatest benefits with respect to restoring natural ecological processes, is an ideal way to offset the fact that Alternative 2 does not have the habitat creation benefits of Alternatives 3 and 4. We believe that Alternative 2 with a realistically sized BR4, as a combined package, would likely surface as the Preferred Alternative, especially taking the long-term effects of global warming and the re-assessed cost of a BR4 with realistic size dimensions into account. Please do a cost benefit analysis of Alternative 2 as a package with BR3 and with a more realistic BR4 to assess which option is best for the environment and public safety. I-3

In the end, we are all going to have to live with the long-term consequences of GGNRA's decision. Please help us ensure that all realistic options have been analyzed before resorting to bridge alternatives that may not adequately address the Purpose and Need of this project. Thank you for the opportunity to comment on this proposal. If you have any questions, do not hesitate to contact me at 415-663-9312 or email to EAC@svn.net.

Sincerely, (Pasted signature will not paste here)

Frederick Smith Executive Director Environmental Action Committee of West Marin

Letter I: Environmental Action Committee of West Marin (March 6, 2007)

Response to Comment I-1

Please refer to MR-1, which includes updated assumptions regarding bridge lengths and widths, and rationale behind selection of the preferred bridge alternative. Also note that the preferred alternative has been changed from BR3 to BR4.

Response to Comment I-2

Although none of the recent IPCC studies estimates a sea level rise of up to 1 meter over 50 years (or even 100 years), MR-3 discusses the potential effects of more extreme sea level rise. The worst case scenarios for IPCC (2001) and IPCC (2007), respectively, are 0.40 meter and 0.28 meter over 50 years, and 0.88 meter and 0.59 meter over 100 years.

Cayan et al. (2006) from the California Climate Change Center also predicted global sea level rise over the next 50 and 100 years using IPCC emission scenarios B1, A2, and A1f1. This study included sea level rise attributable to melting ice sheets and glaciers, which was not quantified in the IPCC studies but was considered too indeterminate. Cayan et al. (2006) predicted that sea level rise could range from 0.1 meter to 0.9 meter per 100 years (or from 0.2 meter to 0.9 meter for the worst case scenario, A1f1). Therefore, the high end of the estimated range for the worst case emission scenario is close to 1 meter over 100 years. Given the amount of uncertainty and wide error band in predicting future sea level rise, we chose to use IPCC (2007), the most widely accepted publication on sea level rise, for this study.

Additional modeling with a tidal increase of 6.5 feet (from 3 to 9.5 feet NGVD), as a proxy for sea level rise, was performed. (See the discussion in MR-3 about flood elevations under projected sea level rise.) The conclusions of this analysis indicate that water levels upstream of the footbridge would be increased by less than 1 foot and that water level increases do not extend up to Pacific Way. Also note that for the scenario that was modeled, flood levels under the proposed project are predicted to be 1 to 2 feet lower than existing conditions. Please refer to MR-3 for a more complete discussion of the effects of sea level rise.

Response to Comment I-3

Please see Response to Comment I-1.

J

Feb. 15, 2007

Carolyn Shoulders
Natural Resource Specialist
Golden Gate National Recreation Area
Fort Mason, Bldg. 201
San Francisco, CA 94123

Dear Ms. Shoulders,

Thank you for including us in the planning process for the Big Lagoon Restoration Project. We'd like to continue this collaborative process for its entire duration. As the finalization of the EIR/EIS nears, we're taking this opportunity to reiterate concerns of ours which we fear have fallen to the cutting room floor.

Our big vision is defined in our primary goal: caring for the Redwood Creek Watershed so that it can continue to nurture and to be enjoyed by future generations. We recognize the terrific challenge of working to simultaneously preserve our environment while ensuring visitors the opportunity to enjoy their public parks; we believe our familiarity with our environment provides a constructive perspective. Here goes:

A shrinking parking lot tied to low-cost public transit and quality of life: In this age of global warming, one of our primary goals is to get cars off the roads. To this end, bus service to Muir Beach is critical.

In the past, we've asked that an ADA-approved bus stop be built at our old Highway One Muir Beach bus location, so that the Muir Woods shuttle can stop here. Now, we realize this is not a good location. The bus stop is too far away from the beach and will require long, ADA-approved trails to reach from bus stop to beach.

A shrinking parking lot is the result of low-cost bus service displacing parking spaces in the Big Beach parking lot; as ridership increases, parking spaces decrease. Final Big Lagoon plans should include weeklong, small-sized non-polluting bus service and a correspondingly small bus stop in the Big Beach parking lot.

J-1

We believe that the Marin Stagecoach is the appropriate-sized vehicle for local, recreational, and handicapped Muir Beach access.

We strongly advocate coordinating transportation planning with the Marin County Transit District and the County of Marin: continuing the week-end Muir Woods shuttle service nonstop to Muir Woods: and re-instating and expanding the West Marin Stagecoach's coastal route. The Stage should run seven days a week: should run more frequently and on a more commuter-friendly schedule: should include more educational outreach to the general public: and should stop both on Highway One and at Big Beach.

We are dealing with a small area and a fragile habitat. We're happy to see that current planning does not increase the number of parking spaces in the Big Beach parking lot, and does not try to serve needs that go off the charts at peak usage periods (e.g. hot summer weekends).

As bus service is tied into the shrinking parking lot, so is the question of growth expectation and/or demand. It is our hope that the shrinking parking lot will, over time, get smaller, and that the Big Lagoon planning process will encourage this as it factors in quality of life considerations, including traffic patterns, commercial encroachment, environmental integrity, and visitor experience. J-1 cont.

Pacific Way Gridlock: Ways must be found to alleviate the gridlock that occurs on peak usage days and paralyzes local, recreational and emergency vehicular traffic.

We have asked for an access road exiting Pacific Way as soon as possible, or at the latest just west of the causeway, and providing adequate stacking distance to prevent backups on Pacific Way. It should also include natural visual screening to minimize noise transmission to nearby residences. J-2

If an access road is not included in the planning process, we ask you to come up with some other structural proposal to control Pacific Way gridlock.

Parking control on peak days: This is not an alternative to our request for an improved physical road realignment on Pacific Way. On peak use days, when the parking lot is full, traffic control officers should be provided on Highway One to direct traffic, and prevent stacking congestion and illegal parking on Pacific Way. J-3

A small number of parking spaces outside the gate: 5-6 parking spaces outside the parking lot gate would allow limited after-hours parking, alleviating congestion and illegal parking on community streets. J-4

Berms: Parts of Pacific Way are lower than the floodplain surrounding Redwood Creek. A build-up of siltation, as well as the construction of berms which were installed as a temporary measure to prevent the creek from overflowing, now trap water on Pacific Way. Pacific way flooding and ponding issues, though difficult, must be resolved. J-5

Aerial tram: The concept of a hilltop tram (close to, but below, ridgeline, on the ocean side) serving Muir Woods (and eventually also other parts of the GGNRA) is a vision we are including in the long-range planning for recreational access to GGNRA lands. Muir Beachers began putting this idea forward thirty years ago, at the GGNRA formation meetings held at Tam High. Now, with our entire world at environmental risk, public transportation has to become more and more attractive and easy to use. While non-polluting buses are a necessary beginning, we hope it won't take another thirty years for us to look back and say, "Why didn't we look to the future and start designing an aerial tram back in 2007?" J-6

Sincerely,

Judith Yamamoto

Judith Yamamoto, Co-chair
Greater Muir Beach Neighbors

Cc: Rachel Warner, County of Marin Planning Department
Steve Kinsey, Supervisor, Marin County Board of Supervisors

Letter J: Greater Muir Beach Neighbors (February 15, 2007)

Response to Comment J-1

As discussed in the responses to Comments C-6 and F-20, public transit improvements are outside the scope of the proposed action. However, NPS is committed to continued coordination with County transit providers, through other planning processes. If bus or shuttle service is routed to Muir Beach in the future, the design of the new bridge and parking lot would be adequate to support bus or shuttle vehicles; only minor modifications to the new facilities would be needed to accommodate a bus or shuttle stop at the parking area.

Also note that planning is based on current conditions; while there are no plans to shrink the parking lot over time, nothing in the EIS/EIR precludes NPS from reducing the size of the parking lot in the future if conditions change. NPS and the County acknowledge that while a smaller lot could be a component of a successful public transportation program, the impacts of creating a smaller lot at the outset without public transportation in place would be adverse.

NPS and the County appreciate the input and note the Greater Muir Beach Neighbors' preference for shuttle stops at both the beach and Highway 1, a shuttle that is similar in size to that of the Marin Stagecoach, and the comments about frequency of shuttle service and public outreach regarding public transportation.

Response to Comment J-2

Public Access Alternative B4, the rotated lot, has been selected as the preferred alternative in the Final EIS/EIR. The turn-off from Pacific Way to the parking lot is as close to the Pacific Way bridge as is practical without requiring a second access road. Alternative B4 has been selected as the preferred alternative because of its superior benefits for hydraulic and sediment transport functions and traffic flow benefits provided by stacking room within the lot for backed up traffic.

Noise impacts on residents resulting from use of the parking lot are discussed in Impact NZ-P3 of the Final EIS/EIR. Local residents currently experience vehicle noise from visitor use of the parking area. Because the same number of parking spaces would be provided as exist today and the number of visitors to the site is not anticipated to change relative to today, noise impacts would not increase as a result of the proposed project.

As discussed in Impact AES-P2 of the Final EIS/EIR, Public Access Alternative B4 would result in improved views for residents and visitors because the rotated parking lot would allow a contiguous landscape to develop, one that is unobstructed by a protruding parking lot. A vegetated buffer between Pacific Way and the parking lot would screen the parking lot from residents on Pacific

Way, and planting bays maintained within the lot would improve the aesthetic value of the site.

Response to Comment J-3

Neither Marin County nor NPS has the personnel to commit traffic control officers for routine patrol on peak-use days but will continue to seek and implement new ways to improve traffic conditions, such as through the use of the Intelligent Transportation System, by which vehicles would be notified by roadside electronic signs that the parking lot is full. Several project actions are likely to improve traffic flow on peak-use days, including the fact that the existing bridge will allow two-way traffic, thereby eliminating a bottleneck; the parking lot would be designed to improve traffic flow; and the preferred parking lot alternative, B4, will have stacking space for back-up traffic, thereby relieving congestion on Pacific Way. On peak-use days, traffic is sometimes slowed by pedestrians in the road; the new trail would help reduce those effects.

Response to Comment J-4

Please note that the project's parking lot is in conceptual design stage, as was used for analysis in the EIS/EIR. As the parking lot design process continues, NPS will consider providing parking spaces outside the gates, as requested in this comment.

Response to Comment J-5

The referenced portions of Pacific Way are not considered by Marin County to be part of this project. The County will look at ponding or drainage issues on the road during bridge design and after construction. This area will be evaluated as part of the visitor parking lot design as well. Hydraulic models can be used to identify whether the berms will be needed to protect the road; it is unlikely they will be needed in the future, and their removal could help drainage of the road. The berms will be evaluated as part of the parking lot design, and any actions related to parking design that can improve drainage of the road will be conducted. Work on Pacific Way would be the responsibility of the County and is outside the scope of the proposed project.

Response to Comment J-6

Comment noted. Construction of a tram is outside the scope of this project.

K

Friday, March 2, 2007

Brian O'Neill
Superintendent
GGNRA
Fort Mason Bldg. 201
San Francisco, CA 94123

Dear Brian O'Neill,

Once again, we thank you for including us in the planning process for the Big Lagoon Restoration Project. It has forced us to look long and hard at the various proposals for Muir Beach, some from the County Board of Supervisors (Marin County Transit District plan), some from the County Planning Commission, and some from your staff and that of the National Park Service.

The proposals which immediately concern us range from public transit options, to expansion and improvement of Pacific Way and of Highway One at Pacific Way, to reconfiguration of the Big Beach parking lot. All of them are intertwined with GGNRA proposals, even if not all of them fall strictly in your jurisdiction. Many of them have evolved, and changed, over time.

Hopefully, the GGNRA can continue to work closely with the County to create optimal planning where these jurisdictions overlap.

We have several specific recommendations for elements of the plans that are now going into the EIS/EIR process:

1. **Public Transit:** Four elements are intrinsically intertwined and we're counting them as one public transit issue. They combine concerns of global warming and our continuing efforts to get cars off the roads, with local and recreational access to West Marin. They are:

a. The necessity of public transit along the Highway One corridor to Stinson Beach, stopping at Green Gulch Farm, Muir Beach, Slide Ranch, and hiking and biking trailheads along Highway One. This means continuation of the coastal West Marin Stage route, with additional weekday runs (for local use), expansion of service, year-round, to weekends (for recreational as well as local use), and designation of a Big Beach stage stop.
b. Use of the West Marin Stage on this route. The Muir Woods shuttle ran every half hour last summer, full, non-stop to Muir Woods. That service fills a real need (congratulations!) and should continue unchanged. It should not stop at Muir Beach. K-1
c. The establishment of a West Marin Stage stop at Big Beach, for true recreational access that is compatible with Muir Beach quality of life.
d. The creation of a "shrinking parking lot" at Big Beach. As Stage ridership to Big Beach rises, the number of parking spaces in the lot decreases, resulting in fewer cars on the roads and a smaller parking lot in the years to come. K-2
e. The addition of five or six parking spaces outside of the Big Beach parking lot, to relieve after-hours congestion on community roads. K-3

2. **Roadway design** must be in keeping with the present environment and must preserve the historic, rustic nature of what is here now – always remembering that this is a small area and a fragile habitat. We are concerned about:

a. The size of the bridge/causeway from Highway One to Big Beach. A 36-foot roadway sounds like overkill.
b. The size of the bus stop at the Highway One/Dairy location.
c. The size of pedestrian/ADA-approved lanes from Highway One to Big Beach.
d. The dramatic impact on the character of this rural road intersection (Highway One and the Dairy) to accommodate a full bus stopping every half hour.
e. Flooding on Pacific Way.

We have actually flip-flopped on the issue of an ADA-approved bus stop located at Highway One at the Dairy. Then we realized that it comes with an ADA-approved walkway to Big Beach and a 36-foot wide Pacific Way, and that the Muir Woods shuttle that would stop there every half hour (or even more often) is always full of Muir Woods visitors. So we rethought the whole concept, which we originally endorsed, and figured out a better way. K-4

It makes much more sense for recreational access to be at the recreational destination, not a quarter of a mile away from it. This is especially true because beach-goers typically carry beach paraphernalia, bathing suits, towels, extra dry clothes, picnic baskets, etc.; they consist of families with babies (strollers, baby carriers) and young children, old folks, and handicapped people.

They are a separate entity from the people headed to Muir Woods.

We ask your planners to scale back the bridge/causeway, address flooding on Pacific Way, eliminate plans to have the Muir Woods shuttle stop at Muir Beach, use only the more appropriately-sized West Marin Stage for recreational access, design a "shrinking parking lot" at Big Beach, add a few parking spaces outside the park gate to remove after-hours parking on community roads, and include a West Marin Stage stop in the Big Beach parking lot for meaningful and practical recreational access. K-5

Thank you for listening to our ideas. We think we have found ways to answer several needs that sometimes seem to conflict with each other, and have created an integrated vision for Muir Beach that is greater than the sum of its parts.

Sincerely,
Judith Yamamoto
Judith Yamamoto, Co-chair
Greater Muir Beach Neighbors

Cc: Rachel Warner, County of Marin Planning Dept., Steve Kinsey, Supervisor, District 4, Marin County Board of Supervisors, Amy Van Doren, Manager, Marin County Transit District

Letter K: Greater Muir Beach Neighbors (March 2, 2007)

Response to Comment K-1

NPS and the County agree with the commenter about the desirability of public transit access to the beach, but, as discussed in the response to Comment C-4, public transit is outside the scope of this project. Comments on the need for additional transit service should be directed to County transit providers for separate attention.

NPS and the County will continue to coordinate efforts to improve transit access to key park destinations and with transit providers to improve transit options and ensure that NPS facilities support appropriate transit access. The parking facilities that would be built under the proposed action may require only minor modification to accommodate bus or shuttle service to Muir Beach if or when such service becomes available.

Response to Comment K-2

The proposed parking lot is considered the minimum size lot to avoid causing traffic and parking impacts. As analyzed in the Draft EIS/EIR, without a public transportation system, a smaller lot would increase traffic problems. If public transit conditions change, it is possible that the footprint of the parking lot could be reduced. Parking lot reduction is not proposed as a part of the Big Lagoon project, but the project does not preclude such future changes.

Response to Comment K-3

Please note that the project's parking lot is in conceptual design stage, as was used for analysis in the EIS/EIR. As the parking lot design process continues, NPS will consider providing parking spaces outside the gates, as requested in this comment.

Response to Comment K-4

NPS and the County appreciate the input regarding roadway design; it is our intent to design all new facilities in keeping with the present environment and the historical, rustic nature of the site.

Regarding concerns related to the size of the bridge and pedestrian lanes, please refer to MR-1; the maximum width of the bridge has been reduced from 36 to 32 feet, including the pedestrian walkway. The reduced width of 32 feet is still considered a maximum width, and further reductions in width may be possible

during the design phase of the project. Regarding flooding of Pacific Way, the preferred bridge alternative would greatly reduce the frequency of such flooding.

Regarding comments on the size and location of the bus stop and the nature and frequency of bus service, public transportation amenities are not part of, but also are not precluded by, this restoration project.

Response to Comment K-5

Please see the responses to Comments K-1 through K-4 above. NPS thanks you for your concern and for participating in the public review process. Your comments will be considered as this project moves through the approval process and design stages.

L

Author Information

Keep Private:	No
Name:	Jeremy J. Levie
Organization:	Green Gulch Farm Zen Center
Organization Type:	I - Unaffiliated Individual
Address:	1601 Shoreline Highway Muir Beach, CA 94965 USA
E-mail:	jjlevie@yahoo.com

Correspondence Information

Status: New	**Park Correspondence Log:**
Date Sent: 03/05/2007	**Date Received:** 03/05/2007
Number of Signatures: 1	**Form Letter:** No
Contains Request(s): No	**Type:** Web Form
Notes:	

Green Gulch Creek Restoration
Green Gulch Farm (GGF) is working on a Watershed Plan that would include restoration work along the Green Gulch Creek. We have at times been cautioned by the National Park Service (NPS) about removing any concrete because it might affect Big Lagoon's restoration due to hydrologic considerations. At times, the NPS has also suggested that we wait until the Big Lagoon project is finished before we begin. So we need to ask, "What effect will the Big Lagoon project have on our creek? Is there a way we can collaborate so that the two projects support each other?" Ideally, we would like to collaborate with the NPS so that our creek restoration can be designed and completed in conjunction with the Big Lagoon project. We feel that cooperating in this way would result in the optimal outcome for the health of the creeks, the Big Lagoon, and the watershed and hope we will be able to proceed in this way. L-1

Horses on GGF 7th Field Pasture
GGF supports the presence of the Ocean Riders in our valley and supports the following changes necessary due to reduction in size of the 7th field pasture:

1. Since it will be more difficult to keep four horses in the smaller space without degrading the land, GGF supports the Ocean Riders' proposal to raise the level of the pony paddocks on the corner of Pacific Way and Highway #1 so they could be used year round and they would be able to trade horses out of the 7th field long enough to rest the land. This work would be done after consultation about any effects on the restoration plan. L-2

2. GGF supports the creation of a new windbreak at the new boundary line of the 7th field. It would be made of native trees and shrubs.

3. Shelters would have to be moved. We would need to work out positioning.

GGF Lot on corner of Pacific Way and Highway 1
Given county land use requirements for building's set back from riparian areas and existing project plans, where is the edge of developable portion of GGF lot that fronts on Hwy 1 and is zoned for commercial activity? If it is determined that given set back requirements and the current design for Big Lagoon there is no longer enough space for GGF to make use of this lot for modest purposes (such as a farm stand), GGF may ask that riparian areas be moved further away from this lot so that GGF may make modest developments on the lot. L-3

Parking Lot at Muir Beach
GGF strongly recommends that the new parking lot at Muir Beach be landscaped with as much greenery as possible to soften its impact on Muir Beach residents viewing it from above and to enhance the visitor L-4

experience of the users of the parking lot. L-4

Removal of invasive species
GGF supports suggestion of removing invasive plant species that occur outside the project area (adjacent to project area) and would welcome NPS assistance in doing this work on GGF land. L-5

Public Access and New Emergency Access Route
GGF has concerns regarding the potential for increased visitation to GGF due to proposed improvements for public access of project area. The loop trail that passes by entrance to GGF could encourage traffic into central GGF area. Increased traffic could be a concern, for example, due to safety within the farm work environment that mixes the uses of tractor-farming and a public thoroughfare.

GGF suggests connecting the Middle Green Gulch trail and the New Emergency Access Route that leads to the beach via the trail located along the southeast edge of Green Gulch farm fields, rather than through central GGF roadway? This would involve improving the trail along the SE edge of the farm fields. L-6

Are there any plans to install trail signs in this area to guide people to complete the loop trail, back to Hwy 1 or back to parking area, and/or up to middle GGF trail that are different from the current state?

Interpretative displays/ signs
The 2004 feasibility analysis appears to describe more details about proposed interpretative displays than the EIS/EIR version. The proposed wildlife habitat viewing platform or blind sounds fine to GGF. The proposed interpretative materials at the southeast end of the parking lot also sound fine.

However, there is some concern regarding the location of the proposed display at the confluence of Green Gulch trail and coastal trail. The committee supports the intent of recognizing, and educating the public about, the traditional indigenous people's uses and habitation of the site, but wonders whether this location is the only option or whether displays could be sited towards the more highly populated and visited areas closer to parking area on NPS property proper. L-7

Are there designs/ ideas about any other signs not already mentioned in previous sections or plans?

Letter L: San Francisco Zen Center (March 5, 2007)

Response to Comment L-1

NPS looks forward to coordinating with SFZC on all technical or logistical issues relevant to restoring the Green Gulch tributary in conjunction with restoring Redwood Creek at Big Lagoon.

Response to Comment L-2

The horse paddock area is a wetland under the jurisdiction of USACE. NPS and Marin County are working to obtain a permit from USACE for all project actions, and we are designing actions to minimize the area of fill in the jurisdictional wetlands. If the total area of fill in wetlands increases compared to the existing condition, it is possible that USACE would require NPS to create new wetlands elsewhere as mitigation. NPS does not plan to add to the total area of fill in jurisdictional wetlands by placing fill in the horse paddock area. However, please note that groundwater elevations are predicted to lower somewhat across the whole site as a result of project actions, a phenomenon that likely would benefit the equestrian use of the site. It is possible the paddocks might be somewhat drier, although they would still be a component of an active floodplain.

NPS is willing to discuss with San Francisco Zen Center and Ocean Riders the planting of native willows on its land at the new boundary of Field 7.

NPS plans to reposition the horse shelter and fencing when they are dismantled in the project area and will coordinate with the San Francisco Zen Center and Ocean Riders as necessary to ensure a mutually acceptable solution.

Response to Comment L-3

It is possible that this comment is referring to the Marin County ordinance requiring proposed developments to have a 100-foot setback from streams. If so, the proposed new location of the main creek channel is more than 100 feet from the pony paddock at the intersection of Hwy 1 and Pacific Way and is thus in compliance with the County's ordinance.

However, there may be numerous other laws or ordinances that could affect the potential development of the corner lot because of the inherent characteristics of the property. For instance, the corner lot is a wetland under the jurisdiction of USACE and within a 100-year floodplain, and other local zoning ordinances

could apply to that location. None of these concerns is under the jurisdiction of the NPS. No project actions are proposed for this corner lot.

Response to Comment L-4

NPS will work with a licensed landscape architect to design and construct the new parking lot. The conceptual designs used for environmental review in the Draft EIS/EIR included vegetated swales throughout the parking lot that would be planted with native species. The vegetated swales will contribute to a more visually pleasing parking lot and also serve the purpose of capturing runoff containing pollutants from vehicles.

Response to Comment L-5

Comment noted. The removal of nonnative species (page 4-112) at the project area will be an integral component of project actions. NPS appreciates San Francisco Zen Center's support and cooperation in removing and managing these species so as to allow the natural integrity of native plant compositions to re-emerge in the project area.

Response to Comment L-6

NPS will work with the Green Gulch Farm to create signage appropriate for the area, as well as gates or fencing that would discourage visitors using the emergency access road from wandering into private property. Since the emergency access road and trail are already exist as public paths to the beach, however, there may not be a noticeable change in visitor use.The possibility of connecting Middle Green Gulch Trail to the route to the beach is plausible and may be considered in discussions with Green Gulch. A possible trail connection from Middle Green Gulch Trail to the route to the beach is currently outside of the project boundaries for this project.

Also note that NPS intends to create a cohesive signage/interpretation plan that provides pertinent information that does not alter the rural, semi-wild character of the area. This approach follows NPS policy 9.3.1.1 that signs

> will be held to the minimum number, size and wording required to serve their intended functions and to minimally intrude upon the natural and historic settings. They will be placed where they do not interfere with park visitors' enjoyment and appreciation of park resources.

The signage plan will be developed during the design phase of the project following the completion of the EIS/EIR.

Response to Comment L-7

As discussed above in the response to Comment L-6, NPS will develop a cohesive signage plan for the site during the design phase of the project. At this point, definite sign locations have not been selected, and NPS is flexible on the location of signs to be established at the site. Sign locations shown on drawings at the intersection with the Coastal Trail are suggested placements, but not definite.

M

Steve Ortega
03/13/2007 09:55 AM PDT

To: Karen Cantwell/GOGA/NPS@NPS, Ann Dolmage/GOGA/NPS@NPS
cc:
Subject: Fw: Westlands and Creek Restoration Project Big Lagoon

----- Forwarded by Steve Ortega/GOGA/NPS on 03/13/2007 09:54 AM -----

Steve Ortega
03/11/2007 11:07 AM PDT

To: MStevenson@jsanet.com
cc: Carolyn Shoulders/GOGA/NPS@NPS
Subject: Fw: Westlands and Creek Restoration Project Big Lagoon

Another comment.

Steve O.
----- Forwarded by Steve Ortega/GOGA/NPS on 03/11/2007 11:06 AM -----

Nancy Hornor
03/10/2007 04:03 PM PST

To: Steve Ortega
cc:
Subject: Fw: Westlands and Creek Restoration Project Big Lagoon

Nancy Hornor
Planning Division Chief
Golden Gate National Recreation Area
(415)561-4937
----- Forwarded by Nancy Hornor/GOGA/NPS on 03/10/2007 04:08 PM -----

"Maureen Pinto" <oceanridermp@prodigy.net>
03/05/2007 10:43 AM PST

To: "GOGA Planning" <GOGA_Planning@nps.gov>
cc:
Subject: Westlands and Creek Restoration Project Big Lagoon

Ocean Riders response to preferred alternatives chosen for Wetland and Creek Restoration at Big Lagoon, Muir Beach.

Submitted March 5, 2007

<u>Restoration Alternative 2 – Creek Restoration</u>.

Ocean Riders presently has challenging space limitations to manage the 18 horses we need to stay financially viable. With the reduction of Field #7 and loss of our grass arena, this will increase our challenges. A herd of 3 is not a healthy 'herd' emotionally or from a management standpoint. Horses bond in twos. With three, one horse is 'left out'. When two people go riding, one horse must not be left alone so herd management must become flexible and an extra space is needed to hold the third horse with companion horses. To help remedy this situation, Ocean Riders proposes the following: M-1

- **We request the minimum amount of land possible is taken from Green Gulch Field 7 for Frog Habitat. While we support protection of this endangered species, it is stated that this action provides *Minor Beneficial* changes in extent of CRLF habitat. We hope this loss to the horses is a worthwhile effort because it definitely impacts our limited usable space. We request a native windbreak be** M-2

planted along the new fence line. The relocation placement of the shelter by NPS to be determined in conjunction with the Green Gulch community. M-2 M-3

- Allow Ocean Riders to restore the back paddock behind stall #8 to have more flexibility in managing the Green Gulch horses. If we lose a herd horse during the winter, as has happened for two winters in a row, we are unable to introduce a new horse into that herd until the ground is dry and the herd can gradually become accustom to the new horse. This is a loss in income. The additional paddock would solve so many of our management challenges that we face without increasing our number of horses. We request this paddock restoration be done BEFORE the wetlands restoration project begins so we can have more options in how we manage our present number of horses, especially with the squeeze on space during the construction period. This paddock can be restored to have no impact on the intermittent watercourse. M-4
- When the levee road is removed and the emergency access becomes the Green Gulch Road, we request enough space is left next to the new locked gate so Ocean Rider's Kawasaki Mule can get through for daily feeding without having to unlock the gate. We request a key to this gate for emergency purposes in case we have an vet call for a pasture horse that cannot be brought in due to illness or injury. M-5
- With the levee road removed, Ocean Riders loses the only flat area of riding which, even though limited, is so important to our horses' mental and physical health. As horses age, they need to 'warm up' before they start climbing hills. If horses are recovering from an injury, they are sometimes restricted to flat riding for a period of time. And for trail health as well as horse health, after a heavy rain, we avoid riding the slippery steep trails. We have used the Levee Loop for these purposes. When considering access from the parking lot to Muir Beach we ask that you consider a HORSE SAFE BRIDGE to connect from the Green Gulch trail over the creek to the proposed multi use trail along PacificWay. During the busy summer days we seldom would be using this but often during quiet winter days this loop would be most important to us for the many reasons stated above. We envision this bridge to be similar to the crossings on the Warm Springs Trail in Tennessee Valley, but wider, with railings. M-6

Fill Disposal Alternatives:

- We have permission from Green Gulch to request that some of the excavated fill material be used to raise the sunken paddocks (we refer to them as the Pony Paddocks) across from the Pelican Inn. They become a stagnant mosquito-breeding pond after first minor rain, rendering them immediately unusable for the rest of the season. Raising them and installing better footing and proper drainage would allow for extended use during the transition seasons (Fall and Spring) to better manage our Green Gulch horses and possibly help protect the flat field. With enough improvement, including run-off control, possibly we could put in portable shelters so they could be used year round for 3 of the pasture horses, allowing brief times to 'rest' the flat field. M-7

Public Access Alternatives:

While we favor ALTERNATIVE B3 we feel the plan does not go far enough to consider the public transportation issue. We are very concerned about the proposal to increase the size of shuttle buses to 35 feet and running even more frequently at 20 minute intervals, not addressing the beach access issues. Talk about Environmental Impact! The rural feeling of Frank Valley changes for the worse with the adverse sounds and smells of large buses' air brakes and fumes, not to mention the safety issue on the narrow winding roads. The buses presently used are very often 'over the line'. I've come to a screeching halt MANY times to allow a bus to round its' curve. Too many tourists who rent cars are not skilled in watching for these behemoths that round the corners OVER the line. Increasing the bus size is a terrible idea that only provides funds for Muir Woods, while impacting both residents and visitor's quality of experience in the rest of the valley. We need SMALLER buses, ie West Marin Stage that can go into the Muir Beach parking lot as well, thus encouraging public transit to and from Muir Beach, not just Muir Woods. M-8

Bridge Alternative BR3:

We appreciate the expansion of a two-way bridge but hope its nature does not take away from the quaint atmosphere of Muir Beach. We are sympathetic with the Muir Beach communities' need for a spur road that accesses their homes separate from those trying to get to the parking lot on busy days. We would like to see smaller Public Transit buses that could truly serve the Muir Beach visitors and community alike. We have noticed that the addition of the public access path is being called a *Pedestrian Path*. We have been told it will be multi-purpose so believe it should be addressed as such so there are no challenges in the future. M-9

In summary, we wish to acknowledge the incredible amount of time, effort and money that has gone into this project. The graphs were very helpful in clarifying the purpose and need. We are grateful that the Preferred Alternatives have been chosen which take the least amount of time and money and appear to have the lowest *impact*. In describing the classification of impacts we would like to say we feel, that unless some of our requests are addressed, the impact to equestrians, especially to Ocean Riders, will not be *minor* , but will be between *moderate* to *major* . We appreciate you taking these requests into consideration as you proceed. M-10 M-11

Respectfully submitted by:
Maureen Pinto
for Ocean Riders of Marin

Letter M: Ocean Riders of Marin (March 5, 2007)

Response to Comment M-1

Comment noted. NPS has worked with the San Francisco Zen Center to adjust the project boundary to reduce the portion of Field 7 removed for inclusion in the project area and thereby minimize impacts on the Ocean Riders equine operation. NPS considers this to be a minimal area for the project. During the preparation of the Draft EIS/EIR, we found it necessary to revise the location of the proposed emergent wetland to protect frog habitat—it was relocated to include a portion of the lower end of Field 7. This will reduce construction impacts on the existing frog habitat. While the analysts for the EIS/EIR have not found the project benefits for frogs to be "major," the species is listed as threatened on the federal endangered species list, and any gain toward a viable population is valuable.

Response to Comment M-2

Earlier in the planning of this project, NPS adjusted the boundaries of the project area to reduce the area of Field 7 within the project boundaries, thereby minimizing impacts on available area for horses. The location for one of two emergent wetlands for CRLF habitat was also adjusted during preparation of this EIS/EIR to reduce potential construction impacts to CRLF, and the inclusion of the lower portion of Field 7 in the project area made this possible. While the EIS/EIS does not find that benefits to frogs are major, any benefit for this threatened species is worthwhile, and, indeed, critical, given their extremely rare sightings in the project area in recent years. The ponded water in their current habitat is dependent upon artificial structures that also make flooding worse (the levee and the undersized culverts under the levee), and the CRLF will benefit from the more natural wetland function of the area. NPS is willing to discuss the planting of native willows at the new boundary of Field 7.

Response to Comment M-3

NPS plans to reposition the horse shelter and fencing when they are dismantled in the project area and will coordinate with the San Francisco Zen Center and Ocean Riders as necessary to ensure a mutually acceptable solution.

Response to Comment M-4

NPS is willing coordinate with Ocean Riders to allow use of the back paddock at the Golden Gate Dairy temporarily during construction because some horses will need to be relocated during that period. Long-term use of the back paddock would be determined through the NPS Equestrian Planning process.

Response to Comment M-5

NPS will provide Ocean Riders with gate keys or codes to allow emergency access through the gate on the access road. NPS will also work with Ocean Riders during the design and installation of the gate to allow access for feeding equipment without needing to open the gate, provided that there will not be enough room for other vehicles to also pass around the gate.

Response to Comment M-6

NPS has not confirmed the need to replace the bridge, which was replaced recently and is in good condition, for this project. If replacement is necessary to accommodate the detailed project design, NPS would consider a horse-accessible bridge. As part of a separate planning process, NPS is planning other trail improvements in the vicinity of Golden Gate Dairy that would provide additional relatively level trail access, such as to the Redwood Creek Trail and to the equestrian facility on State Parks land in Santos Meadow.

Response to Comment M-7

The paddock area across from the Pelican Inn is on property owned by the San Francisco Zen Center, but it is a wetland under the jurisdiction of USACE, as is most of the rest of the project site. NPS and Marin County are working to obtain a permit from USACE for all project actions, and we are designing actions to minimize the area of fill in the jurisdictional wetlands. If the total area of fill in wetlands increases compared to the existing condition, it is possible that USACE would require NPS to create new wetlands elsewhere as mitigation. NPS does not plan to add to the total area of fill in jurisdictional wetlands by placing fill in the horse paddock area. However, please note that groundwater elevations are predicted to lower somewhat across the whole site as a result of project actions, a phenomenon that likely would benefit the equestrian use of the site. It is possible the paddocks might be somewhat drier, although they still would be a component of an active floodplain.

Response to Comment M-8

Shuttle bus sizes and routes are not a component of the proposed project. The bridge would be designed to standard Marin County specifications.

Response to Comment M-9

The pedestrian path noted in this comment is proposed as a multi-use and accessible path. It will accommodate pedestrians, horses, and bicycles. We

anticipate that visitors on road bikes would be more likely to bike on the road than on the path.

Response to Comment M-10

Comment noted. Thank you for your support and your participation in the environmental review process.

Response to Comment M-11

As discussed on page 4-228 (Impact REC-R5), the proposed habitat restoration at Muir Beach would use about 25% of Green Gulch Farm's Field 7. Field 7 is now pasture for four horses belonging to Ocean Riders and would support three horses after restoration. In addition, as discussed on page 4-228, the riding ring west of the access road would be removed to accommodate restoration, although the stalls at the corner of Hwy 1 are expected to remain available. The riding ring is used primarily for turning horses out rather than for schooling or other "ring-specific" uses, so the loss of the riding ring thus would translate into a further decrease in the availability of temporary turn-out space. This loss is expected to be particularly important to visiting equestrians, who are the ring's heaviest users.

NPS is aware that, while equestrian opportunities continue to be available nearby, facilities in the Muir Beach area are limited, so any reduction in those uses will be keenly felt. The decrease in the size of Field 7 was evaluated as a minor effect because it would involve only one horse. By contrast, the loss of the riding ring would affect a larger number of horses and riders, potentially causing some out-of-area users to select another destination, and was identified as a moderate adverse effect (page 4-228). These findings, and the accompanying statement that the overall number of equestrians affected by the loss of the riding ring would be small compared to the total number of equestrians using the site and broader region (page 4-228), were in no way intended to downplay or disregard the importance of that loss to the individuals or overall Ocean Riders operation affected by it.

N

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RECEIVED

March 5, 2007

2007 MAR -7 P 1:52

MARIN COUNTY COMMUNITY DEVELOPMENT AGENCY

Marin Community Development Agency (CDA), Attn: Tim Haddad
Golden Gate National Recreation Area (GGNRA), Attn: Brian O'Neill

The Sierra Club offers the following comments on Wetland and Creek Restoration at Big Lagoon Draft Environmental Impact Statement/Report (DEIS/R).

Comment 1: Future Flood Control

In 1996, after GGNRA assumed the Project, GGNRA Superintendent Brian O'Neill stated:

> *"The Park Service is going to commit itself, publicly, with all of the strength of our conviction to our commitment to do the Big Lagoon Restoration Project... In that regard, we have approached our non-profit support organization…about their willingness to assist in raising private sector support…our proposal would be to utilize a significant portion of the revenue we generate from the fee-program and to leverage that with private sector support under a fund raising effort our Association is committed to do, so we will be able to probably realize the Big Lagoon Restoration Project together with other improvements in the watershed on a schedule that's very similar to that which we've been talking about under the current concept.....The last thing that the Park Service wants…to lose the momentum that we have on Big Lagoon.*

The history of the Big Lagoon Project is an important context, because the Sierra Club believes that this 2007 DIES/R does not study the impacts from future flood control measures that may be proposed during the wait for funding. Thus any future flood control measures must be carefully evaluated with their own separate environmental reviews. The importance of careful environmental review can be seen by the history of GGNRA's controversial 2002 Environmental Assessment (EA) for the "Lower Redwood Creek Interim Flood Control Measures." This project was proposed after years of gradually increasing flooding, yet was presented as a habitat enhancement. As a coalition of environmental groups (Coalition), including the Sierra Club, commented: N-1

> *We do not believe the project is an instream habitat enhancement project for salmonids. The primarily flooding rationale for this project was acknowledged by officials from the National Marine Fisheries Service (NMFS) and California Regional Water Quality Control Board (RWQCB) at a meeting at NMFS offices in Santa Rosa California on 8/21/02…removing fish from their habitat, bulldozing that habitat, and then allowing fish to return to a habitat that has been rendered substantially useless… will inevitably lead to salmonid mortality.*

The Regional Board staff, after extensive discussion and site visits, refused to issue a clean-water permit for the flood control project. In response, GGNRA and Marin County went over the heads of the local Board staff to circumvent the permit process by claiming that the Board "didn't have time" to process the application. As a result, the flood project went forward on a claimed "emergency" basis without normal permits or adequate EA. In fact, the only emergency that actually existed was GGNRA's failure to convince Board

Sierra Club to CDA/GGNRA Re Big Lagoon DEIS/R 3/6/07 Page 2

staff of the environmental merits of the Project. Although GGNRA downsized the flood control project by almost half in response to complaints from the Coalition, the project impacted over 400% more endangered coho than GGNRA had predicted and virtually extirpated endangered California red-legged frogs from the project area. The Sierra Club is determined that GGNRA will not repeat this kind of environmental review "process" and environmental "restoration" project. We have no objection, while this Project awaits funding and construction, to environmentally sensitive pruning of creekside vegetation to discourage flooding, or to mitigated "glory-holing" from the Pacific Way right of way. However, we specifically request confirmation that this 2007 DIER/S is not a programmatic substitute for appropriate environmental compliance for flood control projects that involve bulldozing stretches of the creek. We believe that such projects, if "needed', must be justified by a fair, careful, and non-emergency environmental review. N-1 cont.

Comment 2: Bridge Length vs Width

In 1993, none of Cal Trans's alternatives included a bridge: *"I do not believe that the stream can be re-directed [only] south of Pacific Way as shown in the plans…Why not let the stream do what it wants to do [and] instead elevate Pacific Way over its low spot. This is certainly within the area of Cal-Trans' expertise; it would help flood control for upstream residences"* (Bennett to NPS 11/5//93). Fourteen years later, we finally have plan alternatives that include a new bridge. However, the DEIS/R notes that the 300-ft bridge length allows for better hydrological functioning than the 150-foot bridge, but is not the preferred alternative because its comparatively modest hydrological advantage comes at the cost of a significant increase in cost compared to the 150-foot bridge. We request that the DEIS/R provide back-up data because we believe this comparison is poorly justified. N-2

First, we do not believe that a 300-foot bridge is possible given the constraints. The longest bridge possible is more likely only 50% longer than the 150-foot bridge (i.e. 225 feet, not 300 feet). The DEIS/R thus uses the 300-foot bridge functions as a "straw man" to substantially overestimate the cost difference between the longest bridge possible and the 150-foot bridge. Second, the DEIS/R uses a "mean" sea level rise of 0.7 feet to calculate impacts. We believe this to be conservative estimate and that use of a sea level rise at the higher end of the IPCC range would show greatly increased flooding potential. Thus use of a sea level rise at the upper end of the IPCC estimates would likely show that the DIES/R has substantially underestimated the hydrological benefits of the longest bridge possible. Taxpayers 50-years in the future would not look kindly on having to re-do an undersized 150-foot bridge. Lastly, the DEIS/R notes that Redwood Creek is one of only four creeks in Marin County that provide habitat for endangered coho and that these coho have unique genetic diversity (3-49). These facts argue for the longest possible bridge spanning the floodplain as doing the best for the creek's hydrology and salmon. N-3 N-4

Nonetheless, we are concerned about the aesthetic impact of the bridge width, which the DIES/R does not specify but which appears to be 2 x 12-ft travel lanes, 2 x 2-ft shoulders and 2 x 3-ft pedestrian lanes, for a total width of 36'. This is significantly wider than connector road segments, is out of character with the community, and would encourage excessive speeds. We suggest instead a 26-ft road width (2 x 10-ft travel lanes and 2 x 3-ft shoulders) as a "context sensitive" traffic calming measure along the 225-ft bridge length. This 26-ft width would allow pedestrians to walk along the shoulders as they do now. If a future pedestrian enhancement were desired, then that could be considered and funded as a separate structure, as was proposed for the Coyote Creek Bridge in Tam Valley. The visual mass (area) of a 225x26 bridge is only 8.3% greater than a 150x36 bridge. Aesthetic considerations should adjust the *width* of the bridge, not the *length*. N-5

Sierra Club to CDA/GGNRA Re Big Lagoon DEIS/R 3/6/07 Page 3

Comment 3: Study Alternate Sea Level Rise

The DIES/R analyses several alternatives, but all with the same "mean" sea level rise assumption (0.7 feet by 2060) Sea level rise will materially impact both flood levels and habitat in the Project area. The proposed bridge will last longer than 2060 and sea levels are projected to rise unabated through the end of the century We believe it prudent to run the project models for all bridge and habitat alternatives with the sea level rise predicted at the upper end of the IPCC 2100 projections (1.6 feet). N-6

Comment 4: Provide Stream Alternative Supporting Data

While it is unrealistic to restore the Project area to its historic condition, its present degraded condition, while creating flooding problems, nevertheless also creates good winter/spring salmonid habitat available nowhere else in the watershed. Given these unique coho, GGNRA should protect and expand the Project's winter/spring habitat that may be irreplaceable and critical to their survival. The DIES/R provides insufficient justification for its claim that the Project will provide adequate replacement winter/spring habitat. For example, 2-year berms were reduced to 1-year berms and the area by the current levee borrow pit is proposed to be excavated...presumably to protect winter/spring habitat. But unknown is whether preferred 6"-12" deep habitat exists at all and if so, then how the area and the duration at this preferred depth differs among the various alternatives. Thus it is not possible to comment on the adequacy of this important habitat component of the Project. N-7

Likewise, the ~35 foot width between the berms is presumably designed to balance sediment flow capacity with salmonid habitat, yet without the background data to support the chosen ~35-foot width, it is not possible to comment on the appropriateness of the "balance." Since the prior 2002 Pacific way Flood Control project was veneered as a "restoration project," the Sierra Club is particularly interested to review the data underlying any proposed balance between flood control and habitat restoration. N-8

Comment 5: Monitor and Adaptively manage Back-Beach Lagoon

The DEIRS/R concludes that the Project will not impact projected closure dates or duration for the small lagoon behind the beach. A change in closure dates and duration can be important, as can be seen from the recent fish-kills at Pescadero Marsh, which may be the result of incorrectly projected impacts from a local restoration. The DIES/R conclusion appears poorly supported and we would request additional review of this "no change" conclusion. Regardless of the ultimate DEIS/R conclusion in this regard, we would request that this back-beach lagoon be monitored and the DEIS/R be expanded to include modest adaptive management of this lagoon in the future. Future significant changes to this back-beach lagoon should include additional environmental analysis. N-9

Comment 6: Reintroduce Western Pond Turtle

The DIES/R notes (3-42) that the western pond turtle (a state listed species of special concern) has been extirpated in the project area and includes the possibility of reintroduction only of the red-legged frog (4-159). The Project should also include the reintroduction of the western pond turtle. N-10

Sierra Club to CDA/GGNRA Re Big Lagoon DEIS/R 3/6/07 Page 4

Comment 7: Purchase All Unused Redwood Creek Water Rights

The DEIR/S notes that San Francisco Zen Center (SFZC) retains an appropriative water right (which has not been used since 1989) to divert up to 47 acre feet from Redwood Creek, but that *"as part of the project, SFZC will make an agreement to have the right abandoned, or else NPS will acquire the right. As such, this is not expected to have an adverse impact on SFZC's water right or on future ecological uses of the site."* It is critical to this Project that this transfer or abandonment actually occur, but we do not believe the language in the DIES/R insures this outcome despite the fact that this has been stated as desired for a number of years.

Although the map in GGNRA's 1993 Water Rights Study appears to show Green Gulch within the Tamalpais Water Company tracts that had their riparian rights severed, the DEIS/R's FMV appraisal of the value of SFZC's appropriative water rights should also include an assessment of SFZC's riparian rights (if any) on Redwood Creek. All of SFZC's water rights on Redwood (both appropriative and riparian) should be acquired by GGNRA, rather than formerly abandoned. Abandoned appropriately water rights can later be claimed by others and while we believe that the current status of endangered status of the salmon in Redwood Creek would preclude anyone from exercising this water right in the future (and any attempt to do so would be vigorously protested by the Sierra Club), this is a possible dispute that can be eliminated now by GGNRA acquiring the water right. Alternately, SFZC could dedicate their water right to in stream uses under Water Code section 1707. N-11

MMWD, at the top of the watershed, also has unused water rights that if exercised would impact Redwood Creek and Big Lagoon. In an ill-advised 1999 scheme, MMWD proposed to use some of its water rights in the headwaters of Redwood Creek for bottled water, yet the DEIR mentions only retiring the SFZC rights. GGNRA should make same request to MMWD's to acquire or donate to instream uses their unused Redwood Creek water rights.

Comment 8: Green Gulch Farm Should be "Salmon Safe"

The DIES/R notes impairments flowing into the Project areas from Green Gulch Farm. Green Gulch should agree and the DEIS/R should require as a mitigation that Green Gulch will adopt Salmon-Safe Farming standards to insure that these inputs are reduced. N-12

Comment 9: Purchase Audubon Canyon Ranch (ACR) Parcels Adjacent to Pacific Way

The DEIS/R notes the purchase of SFZC's water rights as part of the Project, however, ACR owns parcels previously offered to GGNRA on the west side of Pacific Way between the bridge and the parking lot entrance. We believe it would b in GGNRA's long-term best interest to own property on both sides of Pacific Way and we encourage the fair-market appraised value (FMAV) of SFZC's water right to also include the FMAV of Audubon Canyon Ranch's Pacific Way parcels with the intent to consummate a purchase. N-13

Sierra Club to CDA/GGNRA Re Big Lagoon DEIS/R 3/6/07 Page 5

Comment 10 Spoils at the Reservoir Site Should Be Compacted to Allow a Water Tank

The DIES/R notes: *"MBCSD pumping decreased instantaneous downstream flows in Redwood Creek by as much as 0.09 cfs. This decrease in flow is primarily significant in the late dry season, when flows are naturally on the order of 0.1 to .2 cfs Lower Redwood Creek completely dries up naturally approximately every 4 years however, MBCSD pumping may increase this frequency to approximately once every 3 years "* (3-7). The DIES/R also notes that the preferred fill *site "was intended for use as a reservoir for hillside crops"* (2-29) and that MBCSD has considered increased storage for residential uses but nothing has happened. Yet the DEIS/R does not study the obvious connection between these observations, thus potentially missing an opportunity that could benefit both salmonids and the local community.

Increased storage capacity could allow MBCSD to decrease pumping during the late dry seasons, which would help salmonids. A similar project to increase storage to avoid dry-season pumping impact on salmonids is being managed by PRNS in nearby Pine Gulch Creek. Increased storage for MBCSD would also increase fire flow capacity and proved for greater flexibility in water system emergencies. Funding (e.g. Prop 50) is available for exactly these types of projects that enhance both water supply reliability and salmonid habitat, yet if the most likely site for the increased storage is completely filled with un-compacted spoils from the Restoration, then this significant opportunity will have been lost. Thus we urge that the DIES/R amend its preferred disposal plan to use the reservoir site only to the capacity and with approved compaction techniques that would allow a water tank to be constructed on the site at some future time. This would provide an incentive for MBCSD to take action on increasing its storage capacity N-14

Furthermore, we believe MBCSD's pumps drying out Redwood Creek, as described in the DEIS/R's is a violation of the requirements of MBCSD's water right that the DIES/R accepts as a given. The DEIS/R should clarify whether the actions it describes are indeed violations and if so, then specify a different and better monitoring program than exists now that will insure that MBCSD does not violate its agreements. If the only result from MBCSD violating its water right agreements is the undocumented death of endangered salmonids, then there will be no incentive for MBCSD to take action on increasing is storage capacity. N-15

Comment 11: Elevate Pacific Way near the Re-graded Parking Lot

The DEIS/R proposes to improve the bridge at the beginning of Pacific Way and to improve the parking lot at the end of Pacific Way, yet leave unchanged the ponding problem in the middle, outside the entrance to the parking lot. Park visitors should not have to cross a multi-million dollar bridge that avoids winter floods, and then have to ford a 50' wide 1' deep puddle in order to access the improved parking lot. Elevating the segment of Pacific Way outside the parking lot could be a use for Restoration spoils. Repairing this segment of Pacific Way seems like a minor but appropriate addition to the over-all project. Elevating this section of Pacific Way would likely require re-grading the north end of the parking lot higher to match, but again that seems easily done by re-grading the southern end section lower, which would also facilitate overwashing of the parking lot that would then be gently graded toward the creek. N-16

Sierra Club to CDA/GGNRA Re Big Lagoon DEIS/R 3/6/07 Page 6

Comment 12: Study Location of Paths

The DEIS/R pedestrian path alternative in Figure 2-13 shows the proposed Project access from the parking lot at the SW corner, similar to the current access. This "indirect" alternative routes beachgoers through dune habitat despite the DEIS/R noting (3-36) "*The [dune] lobes that occur at Muir Beach are disconnected from one another by well-used visitor paths…preventing natural dune formation process*." Furthermore, the Figure 2-13 alternative would strand wheelchairs behind the dunes, out of sight of the ocean.

Figure 2-12 shows the path running from the middle of the parking lot directly to the beach. The Sierra Club expresses a preference for a more direct route with access from the middle of the parking lot as shown in Figure 2-12, but modified (angled southwest as in Figure 2-13) to avoid the back beach lagoon entirely and to decrease the distance to the coastal trail Our observation, based on 18 years of informal monitoring, is that visitors, seeing the ocean directly from the parking lot, tend to jump fences and ignore signs in an attempt to travel in the more direct route to their destination. Furthermore, there is significant foot traffic from the parking lot to the private "little beach" which is north of the public beach. Thus while Figure 2-13's indirect pedestrian access at the SW corner of the parking lot may in theory have less environmental impact, in practice, these impacts must be added to those that will inevitably come from uncontrolled social access directly to the beach. A more direct route would also provide views of the ocean for wheelchairs. N-17

Access through the sensitive habitat should be by an elevated boardwalk that allows environmental processes to continue. The rip-rap that now allows the coastal trail to connect to the current pedestrian bridge from the parking lot should be removed and the coastal trail re-routed to the beach along the base of the hill avoiding the dunes. The connection between the coastal trail and the beach access should be across the beach.

Lastly The DIES/R does not appear to analyze increased traffic (foot and bike) that will occur on the trail connecting the Coastal Trail to Green Gulch when the Levee Trail is removed. The DIES/R notes there will be emergency access along this trail segment, but other uses will also increase. The DIES/R should propose mitigations to reduce new impacts to a level not exceeding current impacts. Furthermore, the proposed increase in the width of this trail to 11 feet is excessive. The renovation of this trail should be limited to vegetation removal and deminimus cut-and-fill not requiring retaining walls. N-18

Comment 13: Restore Trees Lining the Creekside Edge of Pacific Way

The DIES/R does not study the possibility to restore the aesthetically important line of trees lining the creekside of Pacific Way between the bridge and the parking lot entrance. These are Monterey Pines planted in the 1940's that distinctively mark the entrance to Muir Beach yet are nearing the end of their biological lives. The DEIS/R's proposed new pathway along the current creek channel should include interplanting with a native tree species (e.g. Douglas Fir) to preserve the ambiance of Pacific Way. N-19

In conclusion, the Sierra Club appreciates GGNRA's attempts to correct inadequate public input to its flood control projects with increased public input into this restoration project, which we believe has pre-resolved an number of contentious issues and diminished the need for significant comments on this DIES/R. Thank you for the opportunity to comment.

J Gennett

Gordon Bennett, Sierra Club Marin Group Conservation Chair

Letter N: Sierra Club Marin Group (March 5, 2007)

Response to Comment N-1

In order to provide improved winter access along Pacific Way during the period prior to construction of the larger restoration project, the proposed action presented in the Final EIS/EIR includes interim flood reduction measures. Please refer to Page 2-7 of the Project Description, which describes the interim flood reduction measures in detail. A minimal amount of necessary dredging will be performed, and it will be conducted in an environmentally sensitive manner.

NPS and the County do not intend to perform any of these actions on an emergency basis and therefore have included these interim measures in this Final EIS/EIR. Both NPS and the County will obtain all appropriate regulatory permits prior to carrying out the actions. The environmental analysis in the Final EIS/EIR explicitly addresses the potential impacts of these activities at the project (rather than programmatic) level and identifies mitigation measures where appropriate. As such, no separate NEPA or CEQA environmental review is necessary for these actions, and the EIS/EIR represents a fair, careful, and nonemergency environmental review.

Response to Comment N-2

In consultations with a bridge engineer after the close of the public comment period on the Draft EIS/EIR, it was determined that a more realistic “longest possible” bridge is about 250 feet, not 266–300 feet. The cost difference is not substantial; however, the 250-foot bridge has been selected as the preferred alternative because of its superior benefits. See also MR-1.

Response to Comment N-3

MR-3 discusses the potential effects of more extreme sea level rise. The upper end of IPCC (2007) values for 2100 is 1.85 feet, using 2010 as a baseline. Additional modeling with an ocean level increase of 6.5 feet (from 3 to 9.5 feet NGVD) was performed. The conclusions of this analysis indicate that water levels upstream of the footbridge would be increased by less than 1 foot (the maximum increase for existing and design conditions is approximately 0.2 and 0.5 feet, respectively) and that water level increases do not extend up to Pacific Way. Also note that for the scenario that was modeled, flood levels under the proposed project are predicted to be 1 to 2 feet lower than existing conditions. Please refer to MR-3 for a more complete discussion of the effects of sea level rise.

Response to Comment N-4

Please review MR-1. A longer Bridge Alternative has been selected as preferred, in part because it would be the most protective of salmonid habitat.

Response to Comment N-5

Comment noted. As discussed in MR-1, the maximum width of the bridge has been reduced from 36 to 32 feet in the preferred Bridge Alternative. However, the exact width will be determined during the design phase.

Response to Comment N-6

Please refer to Response to Comment N-3 and MR-3.

Response to Comment N-7

Please refer to MR-2.

Response to Comment N-8

The preliminary design dimensions of the low flow channel were selected to allow hydraulic modeling of the preferred alternative. The channel dimensions are first based on existing channel dimensions of Redwood Creek approximately 0.5 to 1 mile upstream at the Banducci site. During the detailed design phase, the following additional analyses will be performed to further refine channel dimensions.

- Historic flow data will be analyzed to better quantify the frequency of smaller high flow events (e.g. the 1- and 1.5-year events). The *Redwood Creek Feasibility Report* (PWA 1998) included a flood-frequency analysis for the 2- to 100-year events, and the *Big Lagoon Feasibility Report Addendum* (PWA 2004) includes analysis of 1999 to 2003 high flow data. During the detailed design, the analysis of high flow data would be expanded to include all data available at that time.
- The “bank full” flow will be selected for different channel reaches. In the upstream portion of the project site (e.g., upstream of Pacific Way), the 1.5- to 2-year event likely will be used for channel sizing. Downstream of Pacific Way, a smaller flow will be selected to increase the frequency of out-of-bank flows to maximize ecosystem restoration. Selection of appropriate design flows will be based in part on further identification and analysis of stable reference reaches within the watershed.

- A suitable range for channel equilibrium slope will be determined using a variety of empirical and analytical methods. The channel planform (i.e., sinuosity) can be modulated, as practical, to achieve a channel gradient that is considered stable. However, the channel gradient also will be dictated by the existing constraints to channel location (e.g., property lines, Pacific Way, etc.)
- Upon final selection of the channel location and gradient, low flow dimensions will be refined. This refinement may include varying channel dimensions at outside meander bends, etc. Selection of low flow channel dimensions will be based on local hydraulic geometry relationships, measurements of reference reaches, and hydraulic analysis. There are no apparent constraints on channel depth or top width; the height of the low flow berms can be adjusted as needed to achieve the desired channel depth while maintaining a uniform channel gradient.

Response to Comment N-9

Please refer to Response to Comment F-11 for a discussion of lagoon closure. We understand that the Gulf of the Farallones National Marine Sanctuary's Beach Watch program captures information regarding the open/closure status of the backbeach lagoon. NPS will develop and implement a long-term monitoring program that would include monitoring of the backbeach lagoon, both immediately prior to, and following project construction.

Response to Comment N-10

Comment noted. The NPS inventory of western pond turtles indicates very low numbers within the areas managed by NPS in the Marin Headlands (Fong 2002), and actions are needed to ensure their long-term viability. Although the habitat conditions at the project site may not be ideal for the western pond turtle, NPS will evaluate onsite reintroduction following construction of the project. Factors used in this consideration will include potential for natural colonization from outlying areas, availability of suitable nesting habitat, and ability to mitigate major barriers to movements and human sources of mortality (e.g., Hwy 1).

Response to Comment N-11

NPS appreciates the commenter's concern regarding the San Francisco Zen Center's appropriative water right. NPS is currently in negotiations with SFZC regarding the steps necessary to allow the restoration project to move forward, and language in the Final EIS/EIR accurately reflects NPS's intent to ensure that instream flows are not diverted from the project area due to either appropriative or riparian rights.

NPS agrees that instream flow protection would be beneficial for coho salmon. However, assessment and/or acquisition of any unused Marin Municipal Water District water rights is beyond the scope of the proposed project. .

Response to Comment N-12

The Final EIS/EIR notes that nutrient sources may include inputs from Green Gulch Farm, among others. It is the intent of NPS to work with adjacent land uses to ensure that unnatural nutrient inputs into the project area are minimized. However, assurance of Salmon-Safe Farming standards being applied to adjacent, offsite operations is not part of the project and, furthermore, is not within NPS authority.

Response to Comment N-13

NPS appreciates the comment regarding acquisition of Audubon Canyon Ranch parcels; however, NPS does not plan any actions on the referenced parcels and considers such acquisition to be outside the scope of the proposed project.

Response to Comment N-14

Comment noted. The Big Lagoon project is not incompatible with potential placement of a water storage tank. Placement of fill at the old reservoir pit does not preclude the possibility of placing a new water storage tank there for the MBCSD. NPS recognizes the importance to MBCSD of obtaining a new water storage tank so that impacts to federally listed salmonids can be avoided or reduced during periods of low flow in the creek. With increased water storage, MBCSD would not have to pump as much water during the low-flow periods, and creek flows during critical periods can be better maintained. NPS is willing to work with the MBCSD to site a new storage tank in the fill placement area or other possible areas on NPS lands in order to protect the habitat for salmonids. There are many possibilities of how a tank and fill could be configured for good placement at the unused reservoir.

Response to Comment N-15

MBCSD holds a state water right to pump groundwater at a well near Redwood Creek for use by Muir Beach residents. The water right requires specific conservation measures for pumping during drought periods to avoid or reduce impacts to federally listed salmonids. It is beyond the scope of this project to determine whether specific practices are legal.

Response to Comment N-16

The referenced portions of Pacific Way are not considered by Marin County to be part of this project. The County will look at ponding or drainage issues on Pacific Way during bridge design and after construction. However, this area will be evaluated as part of the visitor parking lot design as well. Hydraulic models can be used to identify whether the berms will be needed to protect the road; it is unlikely they will be needed in the future, and their removal could help drainage of the road. The berms would be evaluated as part of the parking lot design, and any actions related to parking design that can simultaneously improve drainage of the road will be conducted. Work on Pacific Way would be the responsibility of the County and is outside the scope of the proposed project.

Response to Comment N-17

The *Pedestrian Access to the Beach* section of Chapter 2, on page 2-15 of the Final EIS/EIR, refers to the fact that the ultimate location of the pedestrian bridge could range from near its current location to a more direct route, as referenced in this comment. The bridge design and locations must be ADA compliant and minimize adverse impacts to channel form, hydraulic processes, and habitat while providing a quality visitor experience. This includes a connection to the Coastal Trail, which would be less convenient to visitors if the bridge is relocated farther north toward the tidal lagoon. Chapter 2 of the Final EIS/EIR has been revised to clarify NPS's intention to remove riprap on the left bank of Redwood Creek upstream of the pedestrian bridge.

Response to Comment N-18

It should be clarified that the proposed width would be 12 feet, which is the minimum necessary for emergency access vehicles. Emergency calls are made from the Coastal Trail and Pirates Cove, and it is necessary to have an access road wide enough not to slow response time. The original trail was constructed to a width of 12 feet, and a very limited amount of work is necessary to restore that width. Project actions will not actually build a wider trail, but will remove in-grown vegetation that currently reduces the functional width. Upgrades will be limited to vegetation removal, grading, and minor fill, as stated in the EIS/EIR, and would not require any new retaining walls.

Although this trail may receive additional foot traffic after upgrades are complete, this traffic would not represent a new use and therefore would not result in new or significant impacts to recreation or biological resources. Additionally, this trail would be located on an existing trail that is currently used by farm vehicles and equestrians. Overall impacts to natural resources would be reduced because foot traffic from the levee road, which traverses through the center of the site, would be relocated to the path on the perimeter of the restored area.

Response to Comment N-19

Although the Monterey pines along Pacific Way are nonnative trees, NPS does not propose to remove them as part of project actions because they are not expected to spread into the adjacent wetland area. NPS will consider this comment's suggestion of interplanting native trees and discuss this with a qualified landscape architect as part of planning the trail along Pacific Way.

late - (accepted)

O

Tomales Bay Association

P.O. Box 369
Pt. Reyes Station, California 94956

RECEIVED
2007 MAR -9 A 9:32
MARIN COUNTY
COMMUNITY DEVELOPMENT
AGENCY

06 March 2007

Superintendent
golden Gate National Recreation Area
Building 201,, Fort Mason
San Francisco, CA 94123

EPC
Marin County Community Development
3501 Civic Center Drive, room 308
San Rafael, CA 94903

RE: Draft EIS/EIR
Wetland and Creek Restoration, Redwood Creek, Big Lagoon, Marin County

Dear Sirs:

We recommend adopting a restoration plan for Redwood Creek that would restore the major feature that has been lost, namely Big Lagoon. In order to achieve that goal, the parking lot at the end of Pacific Way *must be removed*. While retaining a much smaller parking area/turn around may be efficacious, the fill associated with removing the parking lot could be used to raise that portion of Pacific Way from the existing bridge to the much smaller parking area, for perhaps 18 cars or less by rotating the parking area parallel to the road and raising it considerably with the fill gotten from the existing parking area, which is historically where the lagoon ought to be.

In addition, we favor alternative BR 4, creating a causeway fully above the flood-plain of Redwood Creek and *allowing* the creek to re-establish its flood plane and lagoon functions. The broader areas and a more fully restored lagoon will give the most chance at success. Otherwise, the project will be primarily an expensive flood control project. O-1

While increasing California red legged frog habitat is worthy and bringing back the salmonid populations that once thrived a major goal, flooding needs to be accepted as a physical reality. We consider that much of the restoration will be achieved if nature is allowed to proceed by strategically removing the man-made obstacles that have proven to be impediments.

Thank you for this opportunity to comment.

Sincerely,

Kenneth J. Fox

Kenneth J. Fox, President

CC open

Letter O: Tomales Bay Association (March 6, 2007)

Response to Comment O-1

The Tomales Bay Association's preferences for project features and alternatives are noted. Please note that in response to public comment, the preferred bridge alternative has been changed to BR4. The association's participation in the environmental review process is appreciated.

P

C. Henry Barner
427 Grandview Avenue
Novato, California 94945
March 3, 2007

RECEIVED
2007 MAR -5 A 8:59
MARIN COUNTY
COMMUNITY DEVELOPMENT
AGENCY

Tim Haddad, Environmental Coordinator
Marin County Community Development Agency
3501 Civic Center Drive, Room 308
San Rafael, California 94903-4157

Re: Draft EIR at Big Lagoon

Dear Mr. Haddad:

A few questions about the DEIR:

1. P. 4-69 Why is no running water being provided where there are picnic facilities and bathrooms? Public health concerns cry out for hand washing facilities where there is food preparation and consumption. P-1
2. P. 4-222 It is stated, "By year 50, all alternatives would be expected to have reached a state of dynamic equilibrium---". Earlier in the DEIR, I was left with the impression that after year 50, more restoration would be required due to factors such as sedimentation build up. P-2
3. P. 4-228 Has consideration been given to just closing the park during periods of heavy construction, especially as it impacts parking and visitor mobility? P-3

I should note that since the County's role is only with the road and the bridge, the above comments are submitted as a private citizen, and not as a Planning Commissioner.

Very truly yours,

C. Henry Barner

Letter P: C. Henry Barner (March 3, 2007)

Response to Comment P-1

Potable water in the lower Redwood Creek Watershed is provided solely by the MBCSD, which operates a groundwater well adjacent to Redwood Creek about a mile upstream of Muir Beach. Data suggest that well pumping can affect flows in Redwood Creek, particularly during dry periods. A water fountain that used to be located at Muir Beach received water from MBCSD, but it was determined in the late 1990s that one of the single largest MBCSD water consumers was the NPS water fountain. Because of the need to conserve water and protect in-stream water flows for the federally listed coho salmon and steelhead, NPS chose to cease potable water services at Muir Beach and removed the water fountain and water faucets.

Response to Comment P-2

The project has been designed such that the potential need for future restoration action is minimized. Although the possibility exists that dramatic future events (e.g., fires, extreme floods) could require additional restoration action, the project has been designed to operate in a state of dynamic equilibrium, and NPS does not have any specific plans to conduct further restoration. Year 50 was used for the purposes of the Draft EIS/EIR to evaluate impacts during the later phases of ecosystem development and represents a reasonable point in the future for planning and impact analysis, considering the increasing uncertainties and difficulty of planning beyond such a time horizon. However, the restoration project is anticipated to be functional beyond a 50-year timeframe.

Response to Comment P-3

Because of heavy demand by visitors, NPS considers it undesirable to close the parking lot during construction; NPS will attempt to maximize access and will not close the facility to the public, except when necessary to maintain construction scheduling. Construction activities that would require parking lot closure include relocation of the parking lot fill, and bridge construction. It should be noted that weekend construction work is not anticipated, and visitors usually will be able to access the parking lot during the weekend peak usage time.

Q

MARGARET KETTUNEN ZEGART
118 HIGHLAND LANE
MILL VALLEY, CA 94941

January 28, 2007

Brian O'Neill, Superintendent
Fort Mason, Building 201
San Francisco, CA 94123
Attn: Restoration at Big Lagoon

Steve Ortega, Environmental Protection Specialist
(415) 561-4841
GOGA_planning@nps.gov

RE: Wetland and Creek Restoration at Big Lagoon Draft Environment Impact State/Environmental Impact Report

Dear Mr, O'Neill and Ortega

Wetland and Creek Restoration at Big Lagoon would initiate restoration of project area, 6.75 acres of land above Pacific Way and Bridge maintained by Marin County, bordering at flood risk Pelican Inn, the lower reach of Redwood Creek near Muir Beach, CA from where the creek passes underneath Highway 1, to its mouth at the Pacific Ocean approximately 2,800 feet downstream.

Major components of the project include:
Reconfiguring the Muir Beach parking lot
Replacing the Pacific Way Bridge and modifying Pacific Way
Recreational and informational enrichment for visitors
Restoring natural function of the creek enabling high flows of sediment to the Ocean
Rehabilitating / enhancing habitat for California Red legged front, Coho Salmon and trout

ES-8 should add goal Acknowledge the cultural values and history of Portugese, agricultural ranch life and mid 20th century tavern enrichments. Q-1

Relocating general parking and lot away from the creek by choosing Alternative C
Alternative B, the "preferred alternative"
a. **does not substantially mitigate the hydraulic obstruction – only moves upward 175 car 90 foot lower parking lot area with stacking vehicles continuing problem** Q-2
b. **Insufficient mitigation for natural creek flow sustainable future successes**. As sea levels rise, wet meadows and marine / tidal systems will creep upward. Q-3
c. **inconsistent with *Draft Marin County Wide Plan***
1. does not correct unacceptable level of service on Shoreline Highway 1. (p. *CWP*2.0-6) 4.23-2
2, measures to reduce traffic flows by an increase for transit service with *MCWP* (i.e. 4.2-1). Q-4

Alternative C provides parking site away from beach and community intercsection
a.175 parking spaces to minimum 118 Cars at Alder Grove location
b.14 Disabled-Accessible Parking Spaces and provide transit drop off spaces to accommodate local users at assigned times
c. Opportunity to modify / lenghtne 14 individual vehicle drop off area to include transit vehicle drop off space; Q-5

d. signed and enforced 15 MINUTE PARKING 10 AM – DUSK. This would add

1. Mitigation to allow local users of the beach early adjacent Beach parking in this area prior to GGNRA visitors' bus drop off consistent with park use
2. Mitigation for sufficient transit plan spaces would focus on and benefit increased transit schedule to Muir Woods Route and GGNRA West Marin destinations for visitors from larger Bay Area and national and international places. Increase frequency of bus / shuttle from SF and Marin Co stagiong area. Q-6
3. Would elimate invididual car stacking congestion approaching beach

e. would be consistent with a *DMCWP* p. 2.0-15 Air 4.3-4 to minimize by buffer any Carbon Monoxide Concentrations along sensitive habitat

f. would be consistent with *DMCWP* p-.2.0-17 4.5-1b "continuing to implement … non-point pollution and run off pollution" into immediate Big Lagoon restoration area Q-7

g would be consistent with DMCWP pp.2.0-28;29 by improved protection of Coastal areas from flooding / tsumani and Seiches measures by relocation of site

h ciould facilitate less Shorfeline Highway congestion at Pacific Way

Provide Sufficient; aesthetic Alternative BR4: 266+foot long bridge with highest road since BR 3 addresses 10 yr flood condition

1.(ES-18) This more costly alternative is preferred " since its substantially greater costs provide greater benefits."

a. .eliminates 3" annual winter flooding and maximum access during increasing "very large storm events" (ES-20) Q-8

b. realizes long term sustainable choice with known and forecasted climate changes – "anticipated water rise and better addresses the reality of seal level rise (up to a meter) and transgression of the marine environment into the valley and creek.

c. length would better balance visual aesthetics of two lane road + multimodal access lanes.

d. allow dramatic entrance design to beach – i.e. the pedestrian bridge at Redding, CA

e. permit enhanced, enlarged and landscaped picnic area without parking lot "fumes"

Recreational and Informational material for Visitors

a. mitigate removal of tavern remnants by kiosk information ES-p. 11 *(see attached) Q-9

b. provide connection of indigenous habitants but extends information about Muir Beach/Big Lagoon residents of this unique area ES-21 but should add

1. Descriptive conjectured/probable maintenance by Native Americans and current GGNRA stewardship Q-10
2. .Residents cultural and agricultural activities; mid 70's regional enrichments*

* earlier attached letters RE: Muir Beach History and incomplete historical/cultural

Thank you for choosing the broader and safer vision of these selected alternative choices.

Sincerely

Margaret Kettunen Zegart

Margaret Kettunen Zegart,

These responses are made from the *DEIR Executive Summary*, since I have not been able to secure a copy of the Draft Report and from concerns raised at scoping and informational meetings, and a Report from the San Francisco Bay Area Wetlands Restoration Program Design Review Group, 2/11/04

√ Cc: Tim Haddadd, Thaddad@co..marin.ca.usa

MARGARET KETTUNEN ZEGART
118 Highland Lane
Mill Valley, CA 94941

August 12, 2002

Golden Gate National Recreation Area
Planning & Technical Services
Steve Haller, Historian
Fort Mason, Building 201
San Francisco, CA 94123

RE: Muir Beach recent history

Dear Steve Haller:

I hope that the material sent regarding Muir Woods, photograph resources and information about Druid Artist Retreat has reached you.

For your information I am copying information that I included in my review of the *Draft Environmental Assessment Element of Lower Redwood CreekInterim Flood Reduction Medaszures and Floodplain / Channel Restoration.*

The gift of Muir Beach by George Wheelwright was inaccurate as written on p. 36. Also, I am not sure if you have this other general historical information, most information is directly from a paper written by Sarah Smiley, June 4, 1970 compiled from interviews of long time residents and by me, also, from other resources..

William Richardson's Rancho Sausalito boundaries were acquired February 11, 1838, a land grant of 19,572 acres. Portuguese were thrifty and hardworking on grazing and farming lands that they gradually acquired and then developed dairy farms at Sausalito Ranch, Franks Valley, at Muir Beach and Green Gulch. On December 12, 1918 Constantine Bello brought ranches K, M and T from Tamalpais Land and Water Company, becoming owner of all Muir Beach Golden Dairy. In 1919 Antonio Nunes Bello built near Big Beach a hotelwhich later burned down. In 1923 Ranch T was subdivided into small lots of Bello Beach. Clayton Bello financed building the tavern and Anthony Nune Belo built it and little cabins on Big Beach. Mr. Ponte hauled the lumber from Smith's Lumber Co. in San Francisco to the site. Albert Silva would1 come to Muir Beach and sell ice cream, soda water and root beer. At Bello's death in 1928, Joseph Weil and Louis Harris acquired ranch K and ranch T and formed the Muir Beach Company, developing a water supply, though muddy and of poor quality.

The tavern had a large hall, kitchen, dining room with (hotel) rooms and one of the cabins was the office of James Weil who moved from New York around 1927..

In 1940 the name changed from Bello Beach to Muir Beach. During World War II there was a coast artillery installation on the overlook and Muir Beach homes were used to house military personnel. Al Santos was a Green Gulch test pilot. In 1945

In 1958 the Muir Beach Community Services District was formed and later, in 1963, the Miwok Corporation. This group formed, developed and marketed the Seascape area, subdividing the remainder of ranch T and began in 1961 the Muir Beach Water System. Local property owners were represented by the Muir Beach Homeowners Association which continues to represent the community in planning concerns with Marin County and other agencies, including dialogue with the GGNRA.

In 1945 George Wheelwright purchased the Green Gulch Farm including a lagoon area bordered by the creek opposite the present Pelican Inn where he created a pasture out of marsh by constructing drainage channels, levees and a dam and excavating a large channel along Redwood Creek. He created seasonal pools for salmonoids and maintained a creek water flow."

In 1945, also, Dr, John and Lucy Brien purchased the beach property and tavern from James Weil and Lucy Harris. In 1963 they sold this 15 acre Muir Beach property to a group of Mill Valley landscape architects and conservationists, including Hugh Call, Robert Greensfelder, Tom Grodner, Asa Hamamoto and Robert Royston. These visionaries remodeled the tavern and tried to make it a successful recreational and cultural destination. By 1967 when "Buddha" held large parties, the summer/flower children gathered here. Concerts by significant groups, ie. Grateful Dead, Clover, or Quicksilver performed. Literary events were held and a restaurant served food.

In 1967, Wheelwright donated the pasture to the State Park System which built a parking lot in its current location at the beach.

In 1968 Dino and Carlo, from San Francisco's North Beach leased the tavern and loud music and nudity and beach litter became a problem.

In 1969 there was a condemnation suit to add the15 acre beach property to the State Park system. An anonymous woman donated $125,000 to aid in the purchase. Owners Greensfelder, Hamamoto, Royston, etc. agreed to sell the property for $250,000. However, the State would pay only $200,000, so, by a State condemnation court settlement, the figure of $247.000 was the purchase price reported in the *Independent Journal*, April16, 1969.

Residents of the Muir Beach community anticipated that the GGNRA would create a recreational area, utilizing existing horse stables and other amenities. At one time a gas station was at the corner of Highway 1 and Pacific Way., but through the Muir Woods Homeowners Association efforts, commercial business have been discouraged.

In 1979 the only tourist service business, the Pelican Inn, opened and it provides seven guest rooms and a pub style restaurant.

In July 1977 the Green Gulch Ranch, original Wheelwright parcel 200-020-09, went to Zen ownership again, by Deed 3178140-77, to the San Francisco Zen Center.

Sincerely,

COPY

Margaret Kettunen Zegart 415 383-2771

Margaret Kettunen Zegart

MARGARET KETTUNEN ZEGART
118 Highland Lane
Mill Valley, CA 94941

August 9, 2002

Golden Gate National Recreation Area
Planning & Technical Services
ATT: Jonathan Gervais, Environmental Compliance Officer
Fort Mason, Building 201
San Francisco, CA 94123

RE: Draft Environmental Assessment, Lower Redwood Creek Interim Flood Reduction Measures and Floodplain / Channel Restoration.

Dear Planners:

By my general reading of this document, these items need commentary or corrections to be helpful or more accurate. Thank you so much for attending to the welfare of Redwood Creek and to begin initiating solutions for this, and estuary / lagoon / beach restoration, and for attention to the needs of the Muir Beach community.

p. 4. 1.01 A brief Introduction and Background
Pacific Way parallel information to the Banducci site description is not included here, although document moves to 2.0 Purpose and Need of Pacific Way

Most helpful would be a general time table for phases in flood and estuary and beach restoration to the Pacific Way site [beyond fall 2002]. A context of phases for **this minimal work to correct flooding at 3.5 years flood level at Pacific Way** *is important* to adequately consider the value / time spent and to determine other alternatives, as more useful. The lower Redwood Creek Restoration, Big Lagoon, Muir Beach community's infrastructure needs and Redwood Creek's health regarding sewerage and septic tank seepage of effluent and the increasing water draw upon the upstream well - all that are affecting the creek are work projects that should also be included in the time table and prioritized in the phases of repair and maintenance recommendations for riparian habit, creek channelization and stream flow and restoration to the lagoon, natural estuary and ocean beach.

p.17 Environmentally Preferred Alternative
The transfer of resources from Pacific Way / Big lagoon to acquire other GGNRA property and to postpone an alternative to correct A flood plain [and community access] to a [new] traditional 100 year flooding event goal is important to discuss, since the purpose and need
(point 1., p. 7) is not met. This document becomes a focused EIR on a minimal first phase.

p.20 Cultural Resources Analyses Although perhaps considered minor, because of high visibility and tourist interest, I believe kiosk signing and building site locations illustrated by photographs and art should be a part of the restoration as well as the explanation of historic uses and ecology of the land around this waterway.[Some wonderful contemporary watercolors of Frank's Valley and this area have been painted by long time Muir Beach artist resident, Larry Yamamoto among others and writings by Alan Watts and others in the Druid's Artist retreat community would also be of high interest.

p.24 *Water Use.*
An adequate assessment of water use and projected increase is needed. Frequent home expansion in this prized real estate area. and increased water use occurs. [*i.e,*. A home at 6 Starbuck Drive will gain 1,737 square feet to a 4,301 square foot home]. Although there are a limited number of new building sites, currently limited irrigated parcels and public landscaping areas, .these should be using tertiary treated effluent in the future.

This section also should be expanded to discuss interrelationship between water use and options of tertiary treatment and the failing Muir Beach community sewer system. [i.e. "Chlorine and Coho in Muir Beach", *San Francisco Chronicle*, 7/2/02, describes an inadequate purification system that some say threatens fish A Rube Goldberg contraption to contain spills was temporarily installed, but its replacement was hardly better, the article continues, and the reported and assessed spill was considered serious by Mia Monroe. Rather than to "upgrade" or replace deteriorating septic systems, for the long term, a satisfactory and safe system sewerage system should be designed that should be included in the phase schedule of future projects with the GGNRA, Marin County and residents. Storm water quality protection is needed for persons, stream and land wildlife. A contemporary use of a natural, reconstructed marsh effluent treatment process seems ideal.

p. 26 mitigation seems "to beg / gloss over" an important future phase point and perhaps should be re-worded.

p. 36 Cultural/Historic Resources is incomplete or inaccurate.
Correctly state the condemnation acquisition process by the State – not a gift - of the beach property by George Wheelwright.
Because of this area's high interest I would hope you would add some of this information, most information is directly from a paper written by Sarah Smiley, June 4, 1970 compiled from interviews of long time residents and by me, also, from other resources..

William Richardson's Rancho Sausalito boundaries were acquired February 11, 1838, a land grant of 19,572 acres. Portuguese were thrifty and hardworking on grazing and farming lands that they gradually acquired and then developed dairy farms at Sausalito Ranch, Franks Valley, at Muir Beach and Green Gulch. On December 12, 1918 Constantine Bello brought ranches K, M and T from Tamalpais Land and Water Company, becoming owner of all Muir Beach Golden Dairy. In 1919 Antonio Nunes Bello built near Big Beach a hotel which later burned down. In 1923 Ranch T was subdivided into small lots of Bello Beach. Clayton Bello financed

building the tavern and Anthony Nune Belo built it and little cabins on Big Beach. Mr. Ponte hauled the lumber from Smith's Lumber Co. in San Francisco to the site. Albert Silva would1 come to Muir Beach and sell ice cream, soda water and root beer. At Bello's death in 1928, Joseph Weil and Louis Harris acquired ranch K and ranch T and formed the Muir Beach Company, developing a water supply, though muddy and of poor quality.

The tavern had a large hall, kitchen, dining room with (hotel) rooms and one of the cabins was the office of James Weil who moved from New York around 1927..

In 1940 the name changed from Bello Beach to Muir Beach. During World War II there was a coast artillery installation on the overlook and Muir Beach homes were used to house military personnel. Al Santos was a Green Gulch test pilot. In 1945

In l958 the Muir Beach Community Services District was formed and later, in 1963, the Miwok Corporation. This group formed, developed and marketed the Seascape area, subdividing the remainder of ranch T and began in 1961 the Muir Beach Water System. Local property owners were represented by the Muir Beach Homeowners Associationwhich continues to represent the community in planning concerns with Marin County and other agencies, including dialogue with the GGNRA.

p. 36 [correction of third paragraph]

"In 1945 George Wheelwright purchased the Green Gulch Farm … including a lagoon area bordered by the creek opposite the present Pelican Inn. ~~Muir Beach~~ where he created a pasture out of marsh by constructing drainage channels, levees and a dam and excavating a large channel along Redwood Creek. He created seasonal pools for salmonoids and maintained a creek water flow."

In 1945, also, Dr. John and Lucy"Brien purchased the beach property and tavern from James Weil and Lucy Harris. In 1963 they sold this 15 acre Muir Beach property to a group of Mill Valley landscape architects and conservationists, including Hugh Call, Robert Greensfelder, Tom Grodner, Asa Hamamoto and Robert Royston.

These visionaries remodeled the tavern and tried to make it a successful recreational and cultural destination. By 1967 when "Buddha" held large parties, the summer/flower children gathered here. Concerts by significant groups, ie. Grateful Dead, Clover, or Quicksilver performed. Literary events were held and a restaurant served food.

In 1968 Dino and Carlo, from San Francisco's North Beach leased the tavern and loud music and nudity and beach litter became a problem.

In 1969 there was a condemnation suit to add the 15 acre beach property to the State Park system. An anonymous woman donated $125,000 to aid in the purchase. Owners Greensfelder, Hamamoto, Royston, etc. agreed to sell the property for $250,000. However, the State would pay only $200,000, so, by a State condemnation court settlement, the figure of $247.000 was the purchase price reported in the Independent Journal, April16, 1969.

"… In 1967, Wheelwright donated the pasture ~~the Muir Beach area~~ to the State Park System which built a parking lot in ~~the~~ its current location at the beach. … "

In 1969, through a condemnation suit, the California State Parks purchased the Muir Beach property. Residents of the Muir Beach community anticipated that the GGNRA would create a recreational area, utilizing existing horse stables and other amenities.

At one time a gas station was at the corner of Highway 1 and Pacific Way. Now the only tourist service business is the Pelican Inn, which opened in 1979 and provides 7 guest rooms and a pub style restaurant.

The Green Gulch Ranch, original Wheelwright parcel 200-020-09, went to Zen ownership; In July, 1977, again, by Deed 3178140-77, to the San Francisco Zen Center.

p. 4 FINAL

Human-cause factors affecting flow velocity, sedimentation and flooding include: …

° height of the barrier NPS Parking Lot

° failure to maintain the creek channel flushing action flow

° insufficient culvert size to accommodate winter storm flow and tidal surges and channel upstream width

p. 20 PREFERRED RESTORATION APPROACH

The value of a phase list by priorities and timetable in the introduction of this document would help this section of the EIR.

Floodplain Inundation Details for Pacific Way area [as done on page 27 for the Flower Field] should be provided here.

Thank you for the opportunity to comment on this document.

Sincerely,

Margaret Kettunen Zegart
KETTZ @ AOL.COM

Letter Q: Margaret Kettunen Zegart (January 28, 2007)

Response to Comment Q-1

Although the goal is part of the larger mission of NPS, it is not a goal of the project. GGNRA recently conducted an evaluation of southern Marin County dairy ranches as part of a determination of eligibility for listing on the NRHP (Weeks and McKee 2006). This work focused on the Portuguese dairy ranching era because of its significance in the history of Sausalito. The study determined that the Golden Gate Dairy is eligible for listing, and, as of June 2007, GGNRA was currently waiting for concurrence from the SHPO on this determination. The resources at the project site do not have sufficient integrity relating to significant historical eras to be considered for listing. However, the likely listing of the Golden Gate Dairy represents an opportunity for preserving and communicating the area's agricultural history. An equestrian plan underway by GGNRA will address cultural resource values and interpretation goals for the Golden Gate Dairy.

Regarding the mid–20th century tavern remnants, project plans have been changed such that the only portion to be removed would be the retaining wall in the wetland, which has adversely affected the function of the wetland and has facilitated the growth of invasive species. Note that the tavern remnants do not have sufficient integrity to be considered for listing in the NRHP.

Response to Comment Q-2

Hydraulic modeling was employed to determine the effects of the removal of parking lot fill on improving conveyance and sediment transport capacity (PWA et al. 2004). A sensitivity analysis was performed on the existing conditions model by testing the impacts of removing a portion of existing fill. The eastern end of the parking lot and picnic area was moved westward 30, 60, 90, 120, and 300 feet. Each of these five parking lot configurations was tested in the hydraulic model under the 5-year recurrence interval (Q5) and 50-year recurrence interval (Q50) conditions. Immediately upstream of the parking lot under Q5 conditions, the hydraulic model showed that water levels dropped by 0.5 feet, 0.7 feet, and 0.9 feet at setback distances of 30, 90, and 300 feet, respectively. A similar hydraulic pattern was apparent under Q50 conditions. The 90-foot parking lot setback was selected as an appropriate minimum distance, given the diminishing improvement in water levels with increasing setback distance. The 300-foot setback would roughly correspond with the conditions under Public Access Alternative C.

Based on hydraulic models, Public Access Alternative B3 would have substantially removed the hydraulic obstruction of the parking lot because it removed more than the minimum area necessary. However, NPS agrees that Public Access Alternative B4 would more fully remove the hydraulic obstruction

and has selected B4 as the new preferred alternative.Finally, while the new preferred Public Access Alternative B4 would, in fact, help relieve vehicle stacking on Pacific Way relative to existing conditions, under Public Access Alternative C, vehicle stacking would be relocated to Hwy 1, which represents a greater traffic safety hazard and would affect a larger number of drivers (i.e., all drivers on Hwy 1, not just those accessing Muir Beach and the surrounding community).

Response to Comment Q-3

Please review MR-3. The new preferred Public Access Alternative B4 will allow sufficient area for natural variation under both current and future conditions.

Response to Comment Q-4

Addressing the existing LOS on Hwy 1 and public transit issues is beyond the scope of the project. As such, neither Public Access Alternative B3 nor the new preferred Public Access Alternative B4 are inconsistent with the *Marin Countywide Plan* inasmuch as these policies are not relevant to the project, nor would the project lead to a degradation of conditions with respect to these policies. Also, please note that the commenter is referring to the draft *Marin Countywide Plan;* the plan was adopted on November 6, 2007. Both Alternative B3 and the new Preferred Public Access Alternative B4 remain consistent with the plan as adopted.

Response to Comments Q-5, Q-6, and Q-7

The preference for Public Access Alternative C is noted, as is the request for the provision of 15-minute parking in the smaller lot at the beach as part of that alternative. Although the provision of such 15-minute parking has merit, NPS has diligently conducted environmental review of the project, in part to determine the preferred alternatives amid the list of feasible alternatives. There are several reasons that NPS has not selected Public Access Alternative C as the preferred public access alternative, including: avoiding additional traffic impacts on Hwy 1, accessibility related to having a lot close to the beach, avoiding impacts on existing habitat at the site of Public Access Alternative C, and avoiding increased traffic issues overall by maintaining the current parking lot capacity.

It is noted that the commenter believes that Public Access Alternative C is more consistent with the draft *Marin Countywide Plan*; as stated above, the preferred alternative is not inconsistent with the *Marin Countywide Plan*. Also, as above, please note that the *Marin Countywide Plan* was adopted on November 6, 2007. The preferred alternative remains consistent with the plan as adopted.

Response to Comment Q-8

The preference for Bridge Alternative BR4 is noted. Please note that the preferred alternative has been changed to BR4. Please also refer to MR-1.

Response to Comment Q-9

NPS evaluated the remnants of the tavern and concluded they do not have sufficient integrity to warrant protection as a historic resource. In response to public interest, NPS will change proposed actions slightly and will leave the tavern's chimney in place. The buried retaining wall will be removed because it affects the functioning of the wetland.

Response to Comment Q-10

Comment noted. NPS appreciates this input regarding the contents of interpretive materials and will consider this comment as project implementation progresses. Please note that NPS plans to incorporate an ethnographic approach into the revegetation plan that will be prepared for the site. This will rely on an understanding of Traditional Ecological Uses of vegetation and will draw upon guidance from the Federated Indians of Graton Rancheria and experts on Native American ecology.

R

Haddad, Timothy

From: KETTZ@aol.com
Sent: Monday, February 26, 2007 8:57 AM
To: Haddad, Timothy; GOGA_planning@nps.gov
Subject: WETLAND AND CREEK RESTORATION AT BIG LAGOON, MUIR BEACH, MARIN COUNTY, CA

MARGARET KETTUNEN ZEGART
118 Highland Lane
Mill Valley, CA 94941

February 26, 2007
Marin County Planning Commission
Tim Haddad, Environmental Coordinator
Marin County Development Agency
1301 Civic Center Drive, Room 308
San Rafael, CA 94941

RE: Wetland and Creek Restoration at Big Lagoon Draft Environment Impact State/Environmental Impact Report

Dear Mr. Haddad and Planning Commissioners:

Wetland and Creek Restoration at Big Lagoon would initiate restoration of project area, 6.75 acres of land above Pacific Way and Bridge maintained by Marin County, bordering at flood risk Pelican Inn, the lower reach of Redwood Creek near Muir Beach, CA from where the creek passes underneath Highway 1, to its mouth at the Pacific Ocean approximately 2,800 feet downstream.

Major components of the project include:
Reconfiguring the Muir Beach parking lot
Replacing the Pacific Way Bridge and modifying Pacific Way
Recreational and informational enrichment for visitors
Restoring natural function of the creek enabling high flows of sediment to the Ocean
Rehabilitating / enhancing habitat for California Red legged front, Coho Salmon and trout

ES-8 should add goal Acknowledge the cultural values and history of Portuguese, agricultural ranch life and mid 20th century tavern enrichments.

Relocating general parking and lot away from the creek by choosing Alternative C Alternative B, the "preferred alternative"
a. does not substantially mitigate the hydraulic obstruction by moving upward the primarily 90 foot lower parking lot area
b. seems an insufficient mitigation for natural creek flow sustainable future successes. As sea levels rise, wet meadows and marine / tidal systems will creep upward
c. inconsistent with *Draft Marin County Wide Plan* since does not correct unacceptable level of service on Shoreline Highway 1. (p. *CWP*2.0-6) 4.23-2
d. inconsistent with *MCWP* (i.e. 4.2-1 measures to reduce traffic flows by an increase for transit service)
Alternative C instead would reduce
a. 175 parking spaces to minimum 118 Cars at Alder Grove location plus 14 Disabled- Accessible Parking Spaces and provide individual vehicle drop off spaces
b. should also modify 14 individual vehicle drop off area to include transit vehicle drop off space; signed NO PARKING 10 AM – DUSK. This would add
1. Mitigation to allow local users of the beach early adjacent Beach parking in this area prior to GGNRA visitors' bus drop off consistent with park use
2. Mitigation of transit plan spaces would focus on and benefit increased transit schedule to Muir Woods Route and GGNRA West Marin destinations for visitors from larger Bay Area and national and international places to change 94% visitors who arrive by private vehicle
c. would be consistent with a *DMCWP* p. 2.0-15 Air 4.3-4 to minimize by buffer any Carbon Monoxide Concentrations

2/26/2007

along sensitive habitat
d. would be consistent with *DMCWP* p-.2.0-17 4.5-1b "continuing to implement … non-point pollution and run off pollution" into immediate Big Lagoon restoration area
e. would be consistent with DMCWP pp.2.0-28; 29 by improved protection of Coastal areas from flooding / tsunami and seiches measures by relocation of parking site
f. removal of lower parking area could be turned into deep pond for enhancing habitat for salmonid outmigration. (Laura Collins)* R-1
g. would be closer to Highway 1 and by well designed staging space, reduce adverse congestion of 175 car parking lot by lagoon.

Provide Sufficient; aesthetic Alternative BR4: 266+foot long bridge with highest road since BR 3 addresses 10 yr flood condition

a. (Executive Summary p-18) This more costly alternative is preferred " since its substantially greater costs provide greater benefits." For maximum access during increasing "very large storm events" (ES-20)
b. Long term sustainable choice because of climate changes… "anticipated water rise
and better addresses the reality of seal level rise (up to a meter) and transgression of the marine environment into the valley and creek."
c. lack of multi-modal lanes on bridge and in Lagoon project inconsistent with Marin County goals, DEIR R-2

Preferred Alternative 2 could phase in future benefits of 3 and 4 restoration modes

ES –21… "enhanced protection of archaeological sites.to original inhabitants of these lands. Residents from the nineteenth century to the present - agricultural ranchers, and cultural diversities of the Portuguese community, Tavern era and Pelican Inn hostelry and adjacent Zen community contribute to the continuing historical enrichment of the Big Lagoon area. (*Attachments)*

Table ES – 1a Restoration Alternatives (page numbers would help in this section)
Watershed Processes
WP-R9 Ability to accommodate sedimentation loads…(Peter Baye) Modify alternative 3 R-3
Proposes sacrificing some marsh space for an expanded lagoon basin letting natural system evolve from there although uncomfortable from
engineering standpoint*

Water Quality Impacts
WQR-11 Salinity changes in Lagoon
Negilible negligible negligible beneficial not really "brackish" as described R-4
because storm surges recharged
salts from mouth occur when plants
dormant and relatively salt insensitive in winter and water flows or surge events would wash out most residual salts.*

ES- 4.3.3 Cultural Resources Impacts
CR- R-7 Removal of tavern foundation Incorporate historical ethnic,
m a m a m a m a agricultural and cultural events and personal narratives in educational visitor material

ES 4.3.4.1 Recreational and Visitor Experience no non-motorized multimodal bike
No bicycle ways provided and this lack lanes provided on bridge and trails
Inconsistent with MCWP_ and present goals along the connecting network and
to parking lot -not along dune strands
(4) significant adverse impacts

ES 4.3.4-4 Energy, Public Services …..
PS F—6 Increased GGNRA transit system Necessary component for reduction
and shuttle services in congestion and accompanying
and adverse CO2 / toxic emissions
and pleasing visitor experience

These responses are made from the *DEIR Executive Summary,* since I have not been able to secure a copy of the Draft Report and from concerns raised at scoping and informational meetings,
*Report from the San Francisco Bay Area Wetlands
Restoration Program Design Review Group, 2/11/04

2/26/2007

Sincerely,

Margaret Kettunen Zegart

COPY
Brian O'Neill, Superintendent

Steve Ortega, Environmental Protection Specialist

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2/26/2007

Letter R: Margaret Kettunen Zegart (February 26, 2007)

Many of the comments in Letter R are similar or identical to those presented in Letter Q. Only new or different comments have been responded to in this letter.

Response to Comment R-1

This suggestion is appreciated. However, the project intends to restore and enhance natural hydrological processes at the site, and there is no evidence that such a pond may have existed in this area. Please note that when the parking lot is removed, the area will function as a winter floodplain, which still will provide valuable habitat for salmonids.

Response to Comment R-2

Please note that the project does propose a separate, multimodal bike/pedestrian facility on the bridge, as referenced in this comment. As such, it is consistent with the *Marin Countywide Plan*.

Response to Comment R-3

An expanded lagoon has been considered as part of Restoration Alternatives 3 and 4.

Response to Comment R-4

The tidal lagoon shifts seasonally from freshwater to brackish water. In the winter months when the beach berm is open and tidal inflows occur, the water in the lagoon can be stratified with saline water at the bottom and fresh water at the top. When the beach berm closes and there are still low freshwater inflows from Redwood Creek, the fresh water and saline water can be well-mixed and brackish. Late in the fall, when freshwater inflows are very low and the berm is still closed, the water can become stratified, with the saline water at the bottom. Although the quantity of fresh and saline water varies throughout the year, saline water is always present in the lagoon. Salinity at different strata of the tidal lagoon was measured monthly during the 1992–1993 analyses for the project (PWA 1994).

S

Haddad, Timothy

From: KETTZ@aol.com
Sent: Tuesday, March 06, 2007 11:53 PM
To: GOGAplanning@nps.gov; Haddad, Timothy
Subject: DEIR Comments re: Access at Big Lagoon

MARGARET KETTUNEN ZEGART
118 Highland Lane
Mill Valley, CA 94941

March 6, 2007
Brian O'Neill, Superintendent
Fort Mason, Building 201
San Francisco, CA 94123
Attn: Restoration at Big Lagoon

Steve Ortega, Environmental Protection Specialist
(415) 561-4841
GOGA_planning@nps.gov

RE: Wetland and Creek Restoration at Big Lagoon Draft Environment Impact State/Environmental Impact Report

Dear Mr., O'Neill and Mr. Ortega:

Wetland and Creek Restoration at Big Lagoon's Draft does not include the multi modal public Access as summarized,

p. ES-12

Bicycle access from Highway 101 and Bicycle Access to the Beach should be included in as a multi modal component of this plan. S-1

Secured bicycle storage in any parking area should be included.
Implementing bicycle transport on shuttle and transit programs should be included. S-2

Prohibition of equestrian and motorized off road vehicles should be discussed and policy implemented for the Beach and trail/path access to the Big Lagoon and Creek Area. S-3

Handicapped access and accommodation for mobility access and information should be included, S-4

p. ES-17

Description of connecting trails, Dias Ridge's and Coastal Trail's recontouring to include multi-modal access should be noted, although their program's design"would be the subject of a subsequent NEPA analysis." The information developed should be included in the future publications and public information articles. The Coastal Conservancy, *A Wheelchair Rider's Guide*, page 16 and 17 should add this information "From Muir Beach to Muir Woods to Stinson Beach." S-5

Sincerely,

Margaret Kettunen Zegart
Cc: Tim Haddad, Marin County Environmental Director

3/7/2007

Letter S: Margaret Kettunen Zegart (March 6, 2007)

Response to Comment S-1

The proposed path would be bicycle-accessible, with bicyclists having the option of using Pacific Way to reach the parking lot.

Response to Comment S-2

Secure bicycle storage features such as bike racks will be incorporated into designs for visitors' convenience and security. However, please note that actions related to a shuttle are not a component of this project and would need to be addressed by operators of a shuttle system.

Response to Comment S-3

The trails in the project area will be multiuse to facilitate full visitor access to and full recreational opportunities on the site. Equestrians will be permitted to use the trails in the project area. Motorized vehicles generally would not be permitted, and the only off-road vehicles that would be permitted would be bicycles or those used for ADA accessibility.

Response to Comment S-4

All trails proposed as part of the project will be ADA-compliant. This pertains to the new path from Hwy 1 to the parking lot, including the portion that will be attached to the new bridge.

Response to Comment S-5

This suggestion is appreciated. It is outside the scope of this project to plan details of the Dias Ridge or Coastal Trail recontouring projects. Please note, however, that the trails referred to cannot meet requirements for outdoor ADA accessibility because of their terrain and steep slopes.

T

Author Information

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Correspondence Information

Status: New	**Park Correspondence Log:**
Date Sent: 03/06/2007	**Date Received:** 03/06/2007
Number of Signatures: 1	**Form Letter:** No
Contains Request(s): No	**Type:** Web Form
Notes:	

The following are my comments relating to the draft EIS/EIR dated Dec. 2006.

Two main issues I have are

a. The alternatives 3 and 4 do not have significant areas of emergent wetland "by design." The result is that the risk rankings are more negative for these alternatives than they might be if the designs included some permanent open water useful for many species. I recommend that these alternatives be adjusted to include some permanent emergent wetland rather than the large riparian forest. This could adjust the relative value of these alternatives. T-1

b. Alternative 4 is the only alternative which will, after 50 years, still have any significant open water, ala Big Lagoon! I recommend that the preferred alternative be adjusted to include some pond area which will provide open water all year. This might be located just south of the access road which parallels Highway 1. If the pond is relatively small, the likelihood of significant salmonids entrapment would be mitigated. T-2

Thanks to all of the contributors for a well done report!

The following are additional more detailed comments.

1. Cover picture and page ES-2: shows a real big lagoon. This is misleading since the least likely alternative (4) is the only one which will actually provide a Big Lagoon. T-3
2. The source of TNC hot spots should be identified. T-4
3. Page ES-4. Why only special status species, why not all native species? T-5
4. Page ES-4. Given that there is a new drainage across Pacific Way near the Pelican Inn, which seems to have, at least this year so far, alleviated the flooding issue, should there be a revision to this document and perhaps a reduction of emphasis on flooding versus habitat improvement. T-6
5. P30: Only endangered and threatened species are mentioned in summary, but a variety of waterfowl and amphibians and fish are also affected and should be generally mentioned. In other words, more common species should also be a driver in restoration since they may be declining with degraded habitat. T-7
6. p35: Native fish, including salmonids, eat a lot of mosquitos too! T-8
7. p35: Due to the loss of access to the marsh area for birding, it would be nice to have some boardwalk into the marsh to compensate and to locate the bird species present each season. We have had regular bird studies of the marsh via the levee road for at least 12 years. T-9
8. p41. The likelihood of self-sustaining ecosystem is not clear based on the modeling. Given the great uncertainties of the models, and of the probability of a self-sustaining system, it may be that this alternative does T-10

not really give the best alternative.

9. Emergent wetland is greatly reduced in Alternatives 1-3 from existing situation. Only Alternative 4 provides much emergent wetland. This is important habitat for many species, and I would think there might be quite a reduction of such things as Black Phoebes, Bobcat and Coyote hunting areas, seasonal ponds for many duck species and more. Can't the preferred alternative be adjusted to reduce the overall Woodland/Scrub to include more emergent wetland? Also the designs of the alternatives therefore bias the Table ES-1a elements VEG-R4 and VEG-R5. This could be improved by design. This also seems inconsistent with WLD-R5. This is particularly important habitat for the nesting Virginia Rails (and hopefully other rails given time). Page 5-20 reiterates the idea that this loss of emergent wetland is "unavoidable." Why can't it be eliminated by design? T-11

10. Alternative 4 is the only alternative that really provides open water year round. The documented decline (via Audubon Christmas count data and other) of waterfowl in the area since 1995 had reduced species diversity substantially. Isn't there someway to adjust the preferred alternative so that there will be open water for 50 years that will not be subject to massive siltation? Perhaps a pond a bit off to one side of the major flood path such as up into the lower Green Gulch horse pasture area. The only real refuge for dabbling ducks right now is the pond on the Middle Green Gulch trial, which is also rather seasonal. Without some open water (long term), the restoration isn't really even close to the 1853 maps. Given that Alternative 3 was not really modeled per se (it was an interpolation of 2 and 4 – page 4-14), perhaps an open water area could still be designed and sustainable? T-12

11. Impact Summary Table ES-1a: Why do alternatives 3 and 4 result in minor adverse effects of reduced flows or dry periods? Given the large uncertainties in the sediment flow modeling, how to we know this accurately? T-13

12. Page ES-25. But exactly how was the determination that Alternative 1 was the best concluded, environmentally? How was the reduction of flood protection, loss of open water and emergent vegetation and other factors weighed against truck traffic and air emissions issues? Also, have all other fill haulage alternatives been exhausted, and where is this documented? This conclusion affects everything and I haven't yet found the details (presumably in the details of the value analysis?). T-14

13. Page 3-16. The assumption of a 0.7 ft sea-level rise by 2060 may be low based on new information. I suggest the modeling be updated for more to consider adverse effects of inundation of the project particularly in severe storm conditions (effects on wildlife, etc., for the various alternatives). T-15

14. Page 5-10. All but the preferred alternative have negative effects on CRLF, I guess because of increased fish predation? But if we have a pond or two, as I suggest above, couldn't we improve their situation? Why no have the wetland off the present GG access road have pond (like it often does seasonally) which is above the floodplain a bit to reduce the chances of it retaining too many salmonids? Again, seems like a bias toward alternative 2 which could be corrected easily by design. T-16

End of comments.

Letter T: David M. MacKenzie (March 6, 2007)

Response to Comment T-1

It would be possible to modify the lagoon alternatives to include more emergent wetland. In fact, the long-term development of emergent wetland in the lagoon alternatives was one of their attributes. However, the lagoon alternatives were not selected because of a combination of factors; added emergent wetlands in those alternatives would not alter that evaluation. The enormous quantities of soil that would have to be excavated and hauled for the lagoon alternatives—and the likely refilling of the lagoons with sediment—was a large factor in screening them out from the preferred alternative.

Response to Comment T-2

Under the preferred alternative, areas of open water would continue to exist along the creek channel, in backwater channels, and within the backbeach tidal lagoon. In addition, during the wet season, it is anticipated that the site will continue to exhibit periods of extensive inundation and seasonal ponding, particularly within the emergent wetland areas (please refer to MR-2). Although more extensive open water areas were considered in Restoration Alternatives 3 and 4, the additional volume of excavation was determined to be prohibitive.

Response to Comment T-3

The Draft EIS/EIR cover photo shows an existing winter condition at the site, with the intermittent tidal lagoon in the foreground and ponding behind the levee road in the center of the photo (the Green Gulch pasture). Although the preferred alternative does not propose to excavate a large lagoon in the pasture area, the area still will be subject to inundation similar to that shown in the photo. The primary difference between the photo and the preferred alternative is that there will be more tree cover in the pasture area. The cover of the Final EIS/EIR has been revised to show the view north from the beach, standing near the tidal lagoon. Post-project, this view would remain unchanged with the exception of enhanced vegetation.

Response to Comment T-4

The Nature Conservancy's 25 global biodiversity "hot spots" were identified in:

Stein, B. A., L. S. Kutner, and J. S. Adams, eds. 2000. *Precious Heritage: The Status of Biodiversity in the United States*. Oxford: Oxford University Press.

Response to Comment T-5

All the federally and state-listed special-status aquatic species at the site have experienced substantial impacts on their habitats over recent decades. NPS Management Policy 4.4.2.3 states, "NPS will survey for, protect and strive to recover all species native to national park system units that are listed under the Endangered Species Act." As such, actions to provide habitat for special-status species drive specific elements of project design, and that is why this is listed as a project goal.

As for native species, NPS Management Policy 4.4.2 states, "Whenever possible, natural processes will be relied upon to maintain native plant and animal species and influence natural fluctuations in populations of these species." The project would enhance habitat for many native species that are not listed under ESA or CESA, as discussed in Impacts WLD-R5, WLD-R6, and WLD-R18. Additionally, floodplain, wetland, and riparian functioning would be improved to ensure a higher quality of breeding and foraging habitat for native species over the long term.

Response to Comment T-6

The new drainage on Pacific Way does not permanently solve the flooding issue at this access point. The new drainage helps drain water off the road, but it does not reduce flooding on the road during larger storm events. The uncontrolled flows during such events represent a substantial flooding problem that impairs vehicle access. As such, the conditions are not sustainable and need to be addressed.

Response to Comment T-7

Common wildlife species, such as lizards, garter snakes, sparrows, blackbirds, black-tailed deer, coyote, squirrels, perch, and sculpin, are discussed in Chapter 3, *Affected Environment*, section 3.2.2 *Wildlife and Wildlife Habitat*. Impacts on common species of wildlife are discussed under Impact WLD-R18.

Habitat requirements for listed species, according to ESA and CESA, are presumed to be protective of more than those listed species. Thus, when water quality and instream habitat are improved for coho salmon, for example, other species (vegetation, insects, other salmonids, and birds) benefit from the improved habitat as well. Although the goal of the proposed project is focused on listed species, the project is anticipated to benefit all of the native species that use the habitat types that will be available following restoration.

Response to Comment T-8

Comment noted.

Response to Comment T-9

Comment noted. NPS will consider the incorporation of bird blinds and boardwalks into the marsh as project design continues.

Response to Comment T-10

The project design and environmental analysis has used valid scientific approaches and the best available information to predict future conditions at the site. Although uncertainty regarding future conditions is unavoidable, the project has been designed to create self-sustaining habitat to the extent that the natural area will be mostly unconfined, and changes in the channel or in the habitat type will be allowed to occur with minimal interference by land managers. In terms of sustainability, this represents a substantial improvement over existing (confined) conditions.

Response to Comment T-11

The conceptual designs shown in this EIS/EIR have more extensive areas of emergent wetland than the conceptual designs in the Feasibility Analysis Report (PWA et al. 2004). New areas would be excavated, and the existing emergent wetland (the cattail area) in the southern portion of the pasture would not be removed as part of the project. It is possible that the cattail area may persist, although this is uncertain.

Designing the project to contain even more extensive areas of emergent wetland would be difficult. Relocation of the channel would result in a decrease in groundwater levels, which would have the tendency to dry out the site. Extensive excavation, therefore, would be necessary to bring the ground surface close enough to groundwater to allow emergent wetland to persist throughout the site. Such excavation would disturb the site extensively. Fill disposal and related haul trips also were a determining factor in selecting Restoration Alternative 2 as the preferred alternative over Restoration Alternatives 3 and 4, and they are generally regarded as undesirable.

Please also refer to MR-3, which discusses the potential shifts in habitat mosaics over time in response to sea level rise.

Response to Comment T-12

Please refer to Response to Comment T-2. In addition, although an off-channel orientation could reduce sedimentation, a pond would still be subject to siltation during routine storm events that result in standing water throughout much of the site. These larger events carry heavy sediment loads, and off-channel open water features would still fill in over time. Achieving conditions similar to those in the 1853 maps is not possible over the long term because of elevated sediment loads from the upper watershed, which have been semipermanently increased because of the legacy of land use in the watershed. Therefore, extensive excavation has been determined to be undesirable because of its relatively short-term benefits weighed against the impacts of fill hauling and extensive site disturbance.

Response to Comment T-13

Please refer to the discussion of Impact WP-R2. Evaporation losses would be increased as a result of the increased extent of open water habitat. In addition, excavation of the lagoon bottoms would lower groundwater levels in the immediate vicinity of the lagoons by several feet. This lowering of groundwater may decrease in association with anticipated sea level rise. Although water is expected always to be present in the lagoons during the dry season, the reduction in groundwater levels could result in reduced instream flows in Redwood Creek. This reduction would be caused by the thalweg elevation of the creek being higher than the groundwater level in the zone of influence of the lagoons. This also would be reflected in decreased flows downstream. Although such impacts are not certain, particularly with the range of estimates in sea level rise, they have been included because they are reasonably foreseeable.

Response to Comment T-14

Please refer to the discussion on pages 2-51 through 2-52. Section 101(b) of NEPA presents a variety of criteria for determination of the environmentally preferred alternative. In general, the criteria stress a balance between project benefits and the degree of adverse impacts. All alternatives would provide ecosystem benefits and would provide unique recreational opportunities. Restoration Alternatives 3 and 4 would have some benefits that would not be experienced under Restoration Alternative 2, such as increased diversity and more even representation of habitats at the site. However, it was determined that adverse effects related to the construction of these alternatives outweighed these benefits. Impacts of construction that would be more severe under Restoration Alternatives 3 and 4 include increases in air emissions; the extent of disturbance to habitat and biological resources (including populations of special-status species); the potential for disturbances to cultural resources; effects of noise and diminished aesthetics on visitors and residents during construction activities such as fill hauling,; and the duration of construction. The benefits of the alternatives also would have a tendency to be reduced over time, as ongoing sediment loads would cause the alternatives to trend gradually toward conditions that are similar

to those of Restoration Alternative 2. As such, it was the judgment of the EIS/EIR authors that Restoration Alternative 2 represented the environmentally superior alternative.

Response to Comment T-15

The latest IPCC (2007) predictions for future global sea level rise over the next 50 years are lower than those estimated in IPCC (2001). However, MR-3 discusses the potential effects of more extreme sea level rise. The upper end of IPCC (2007) values for 2100 is 1.85 feet, using 2010 as a baseline. Additional modeling with an ocean level increase of 6.5 feet (from 3 to 9.5 feet NGVD) was performed to accommodate both sea level rise and severe storm conditions. The conclusions of this analysis indicate that water levels upstream of the footbridge would be increased by less than 1 foot and that water level increases do not extend up to Pacific Way. Also note that for the scenario that was modeled, flood levels under the proposed project are predicted to be 1 to 2 feet lower than existing conditions. Please refer to MR-3 for a more complete discussion of the effects of sea level rise.

Response to Comment T-16

The goals of presenting Restoration Alternatives 3 and 4 were to evaluate the implications of trying to achieve conditions that were more similar to the historical (pre-1853) conditions at the site. Constructing additional ponds that are separate from the active channel does not fit within the overall approach of these alternatives, as such ponds were not present historically. If CRLF impacts had been the only issue that prevented these alternatives from being selected as the preferred alternative, NPS could have considered design modifications for CRLF. However, as stated earlier, there were many reasons that these alternatives were not selected as preferred, including increased costs and extent, intensity, and the duration of impacts.

U

Keep Private:	No
Name:	John and Cela O. O'Connor
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Correspondence Information

Status: New	**Park Correspondence Log:**
Date Sent: 03/07/2007	**Date Received:** 03/07/2007
Number of Signatures: 1	**Form Letter:** No
Contains Request(s): No	**Type:** Web Form
Notes:	

We are very familiar with Big Lagoon. Years ago in the 1950's you could pitch lures into the lagoon for salmonids that would hold up waiting to go upstream.

While the Preferred Project Alternative 2 is financially the most beneficial to the Park, it is clearly not the most beneficial to the wildlife and the public. It will restore a very limited variety of environment, namely riparian. The creek remains channelized which will lead to deposition of sediments and corresponding flooding problems.

More valuable to the now limited salmonid populations is Project Alternative 3 with the two dredged lagoons interior to the parking area. Preserving the existing race of coho in Redwood Creek should be the primary goal of the ecological restoration. The exterior tidal lagoon should be increased to at least three or 4 times the suggested increase to help attain this goal. The increased open water overall would also benefit returning birdlife/waterfowl once present, but now missing from the landscape. U-1

It is unclear how the new creek channel adjacent to the dunes will be able to sustain this position without encroachment from the dunes forcing the creek channel towards the now existing channel. This may again lead again to a plugged section of the creek if the parking lot is not reduced further that the Preffered Alternative #2 describes. U-2

Retaining a 175 car parking lot B-3 Alternative may lead to the same problem that now exists from the present parking lot even though a small section of the lot would be removed. A more reliable solution to the eventual possible plugging of the creek flow would be to shrink the parking lot to the size of the lot in Alternative C or Alternative B-1 with 118 cars at Alder Grove. Safety concerns for the new roadway parking lot could be mitigated through appropriate signage. Appreciably reducing the size of the parking lot would add to the visitor experience. No matter what is done with the oversized 175 car lot it is still a giant eyesore and has always been out of place at this site. Flooding problems would be less likely to occur with the increased floodplain. U-3

Retaining the existing capacity of the parking lot does not encourage public transit authorities or the public to move forward to achieve alternate forms of transportation relative to visiting our parks. U-4

Alternative BR3, 150 ft. bridge with the raised road could be the most beneficial when combined with the Project Alternative 3 and a greatly reduced parking lot which would yield a larger floodplain where it is needed the most. U-5

I encourage the park to look again at the overall picture and move toward a more ecologically balance restoration. It would be worth the added expense. Thank you for the opportunity to comment.

John and Cela O'Connor

Letter U: John and Cela O. O'Connor (March 7, 2007)

Response to Comment U-1

The alternatives analyzed in the Draft EIS/EIR represent tradeoffs between different habitat values; the commenter is correct in that Restoration Alternative 2 is more heavily weighted toward riparian wetland habitat compared to Restoration Alternatives 3 and 4, which are weighted toward open water habitat. Selection of the preferred alternative considered many factors, including cost and benefits to wildlife and the public; Restoration Alternative 2 was determined to be the most beneficial overall. Please refer to Page 2-45 for a complete discussion of the decision-making process and factors considered in selecting the preferred alternative.

With respect to benefits to salmonids, the Draft EIS/EIR found that the various action alternatives were very similar. All alternatives would greatly reduce the potential for entrapment as a result of out-of-bank flows or channel avulsion. A similar extent of juvenile rearing habitat would be present under all alternatives. For Restoration Alternative 2, this would be primarily in the form of backwater channels, in-channel pools, cover provided by LWD, and floodplain habitat during high winter flows. Restoration Alternatives 3 and 4, in contrast, would provide this habitat in the form of the lagoons rather than through backwater channels and in-channel features.

Response to Comment U-2

Historically, the channel downstream of the pedestrian bridge was located in the easily erodable beach sand. During high flows, the channel could readily respond to migrating sand and other sediment by scouring vertically and laterally. It is suspected that over time, old channel armoring from near the parking lot was displaced downstream and prevented the lower channel from downcutting. This led to the condition in 2002 when the channel could not cut through the cohesive sediment and dense vegetation that established downstream of the footbridge. The proposed project seeks to prevent this condition from reoccurring by:

- relocating the channel beachward into the open sand,
- removing any buried riprap that could inhibit channel mobility, and
- rotating the parking lot.

These modifications are intended to increase the sustainability of the channel located in the back beach. However, since the 2005/2006 winter storms, the creek channel has eroded through the erosion-resistant material into underlying beach sand. This may make it unnecessary to relocate the channel.

In the restoration design, multiple changes will work in combination to allow the channel the mobility needed to address the existing condition (the parking lot

modification, the levee road removal, the riprap removal, and allowing the channel to cut through the sandy area downstream of the pedestrian bridge.

Response to Comment U-3

Since publication of the Draft EIS/EIR, NPS has chosen to select Public Access Alternative B4 as the preferred alternative to improve floodplain connectivity and sediment transport functions. Regarding the effects of the parking lot on flooding, hydraulic modeling was employed to determine the effects of removal of parking lot fill on improving conveyance and sediment transport capacity (PWA et al. 2004). A sensitivity analysis was performed on the existing conditions model by testing the impacts of removing a portion of existing fill. The eastern end of the parking lot and picnic area was moved westward 30, 60, 90, 120, and 300 feet. Each of these 5 parking lot configurations was tested in the hydraulic model under the Q5 and Q50 conditions. Immediately upstream of the parking lot under Q5 conditions, the hydraulic model showed that water levels dropped by 0.5 ft, 0.7 ft, and 0.9 ft at setback distances of 30, 90, and 300 feet, respectively. A similar hydraulic pattern was apparent under Q50 conditions. The 350-foot parking lot setback under Public Access Alternative B4 was selected as an appropriate minimum parking lot setback distance, given the improvement in water levels with increasing setback distance.

The commenter also brings up other issues related to the size and location of the parking lot, such as safety concerns, aesthetics, and visitor experience. The Final EIS/EIR determined that relocation of the parking lot to the Alder Grove under Public Access Alternative C would have substantial safety issues for bicyclists, pedestrians, and equestrians that could not be fully mitigated through signage. Regarding aesthetics, the reconfigured parking lot under Public Access Alternative B4 is anticipated to be an improvement over existing conditions, as it would have less of a protrusion into the landscape. Views also would be improved through installation of planting bays between parking rows. Finally, regarding visitor experience, the Final EIS/EIR concluded that reduced parking lot capacity would adversely affect visitor experience for those visitors having difficulty finding parking; thus, the proposed alternative would maintain the current number of parking spaces.

Overall, Public Access Alternative B4 was determined to be the best option to balance multiple project objectives while avoiding or minimizing environmental impacts.

Response to Comment U-4

NPS agrees that reducing the parking lot capacity will not encourage the use of alternative transportation. However, if alternative transportation does not exist and the parking lot is reduced, adverse traffic impacts on Pacific Way and Hwy 1 will occur. This project seeks to coordinate with regional transportation planning, but planning means for alternative transportation is outside the scope of this

project. Nonetheless, NPS will not preclude the possibility of reducing the parking lot in the future, if conditions change.

Response to Comment U-5

The preference for Bridge Alternative BR3 and Restoration Alternative 3 is noted. Thank you for your participation in the environmental review process.

V

Haddad, Timothy

From: Walter [Postle@wildblue.net]
Sent: Friday, January 05, 2007 11:56 AM
To: Haddad, Timothy; GOGA_Planning@NPS.gov
Subject: Restoration at Big Lagoon

Gentlemen:

I would appreciate if you would include the following comments on the Draft EIS/EIR for the Big Lagoon Restoration Project.
Sincerely, Walter Postle, 40 Sunset Way, Muir Beach, Ca 94965
January 4, 2007

Comments on the Big Lagoon Restoration Project

Personal Note: When I moved to Muir Beach in 1973 into a house which overlooks the project site, there were cattle and horses on the hillsides; flower fields in the valley; fish and turtles in Redwood Creek which ran clear and fast. Pacific Way was not flooded and you could buy a soft drink from a stand near the low lying parking lot. In the spring the air was filled with thousands of butterflies. It was a beautiful and interesting landscape with an incomparable soundscape.

After the NPS took over from the State in the early 1990's things changed for the worst with NPS racking up a dismal record. NPS festooned the beach with fences and signs of every description all claiming to warn visitors from disturbing the fauna and flora. The livestock, flowers, turtles, California Red Legged Frogs, butterflies and the hot dog stand all disappeared. The number of fish in the creek dropped away -- the last time I saw fish in Redwood Creek was a couple of years ago and they were floating upside down under the Pacific Way Bridge. NPS let the mouth of the creek to fill up with the result that the water table rose and many trees in the alder grove and along the creek were drowned. Many fell into the creek. The parking lot (a major eyesore) was extended across the valley and raised well above sea level. Ignorant NPS managers found it a convenient place to dump highway spoils. Protests from the locals, that the stream bed and outlet to the ocean was blocked were ignored. Evidently a bright spark in NPS wanted to "restore" the dunes which disappeared literally overnight in major storm in 1982. It did not matter that houses were flooded and the roads covered with a couple of feet of water. Got to have those sand dunes! The creek bed is now clogged with debris and hundreds of thousands of the taxpayer's money has disappeared in attempts to remove the mess. Not a dime was spent widening or deepening the outlet to ocean-- a quick and effective fix. I recall the NPS in order to improve drainage to the Ocean from the entire Redwood Creek watershed, cut a 48 inch wide (!!!) channel through a grove of trees for what it laughing called "an experiment"-- I guess to find out if water flowed downhill. V-1

1/5/2007

In my opinion, the degraded condition of the area we see today is a direct result of incompetent and negligent management. The federal managers, like Brownie, have done a great job. The villains are not those who farmed the land around Redwood Creek in years past but the folks who are around today drawing paychecks and claiming a mandate to protect the land. V-1 cont.

Specific Comments: If the EIS/EIR is to be believed, we will be lucky to see this project finished in 2010 or 2011-- about 20 years since the first meetings were held to discuss the "restoration" of Redwood Creek. I think most folks would agree that this schedule is a bit slack. This schedule and the NPS's blemished record in Redwood Creek undermine the credibility of this project. V-2

One would think that after all the meetings and the blizzard of paper that this project has created over the years that we would at last have proposals that would resolve all outstanding issues. No so. This plan is defective because it does not answer the core question at Muir Beach: Do we want preserve a unique animal resource or do we want easy parking? We cannot have both. A viable fishery and a giant parking lot cannot occupy the same space.

THE PROPOSED PARKING LOT (ALTERNATIVE B-3-175 CARS AT BEACH) IS TOO BIG, TOO CLOSE TO REDWOOD CREEK, WITH 275 SPACES HAS TOO MANY PARKING SLOTS AND INTRUDES TOO FAR INTO THE RIPARIAN HABITAT. THE PROPOSED ADDITION TO THE FISH HABITAT IS TOO MODEST TO FULLY RESTORE THE FISHERY. V-3

We will always be able to find parking but we will never be able to find fish if we pave over their breeding pools and poison the creek with automobile runoff. We must take the opportunity provided by this project to restore the largest fish habitat possible not the largest parking lot that can be squeezed in close to the beach. Moving the parking lot away from the creek and reducing its footprint is essential for the health of Muir Woods and the watershed. There is no good reason for the parking lot to cut across the mouth of Redwood Creek. The petty changes NPS recommends in alternative B-3 will not do the job. Go back to the drawing board,

I note that NPS proposes to remove the remains of the Muir Beach Tavern. The tavern, which was a major feature of the beach for more than 30 years, is part of the history of the area and should be left alone. There are lots of photographs of the Tavern the site is of equal value as the invisible camp grounds once occupied by the Gratton tribe although it doesn't have the same PC cachet. Remember that the Gratton folks are not sound on environmental protection. Recall that they wanted to build a Casino, hotel and other extravaganzas in the wetlands of Sonoma County. Good luck with this crowd. V-4

Apart from the fatally flawed parking lot option and the strange proposal to destroy the remains of the tavern, I consider the remaining preferred alternatives to be comprehensive and practicable. The EIS/EIR is really a pretty good job--much better than the material produced for the unlamented Comprehensive Transportation

1/5/2007

Management Plan.

1/5/2007

Letter V: Walter Postle (January 5, 2007)

Response to Comment V-1

Comment noted. This is not a comment on the disclosures and findings of the Draft EIS/EIR.

Response to Comment V-2

Comment noted. NPS maintains that the schedule disclosed in the Draft EIS/EIR is realistic.

Response to Comment V-3

NPS has balanced multiple objectives in selecting its preferred alternative, including project objectives and environmental effects, and will continue to review this information as decisions on project alternatives are selected and implemented. As such, NPS has changed the preferred Public Access Alternative from B3 to B4 to improve floodplain functioning and riparian habitat. NPS recognizes that this alternative would provide the most benefit to fish habitat. Please also note that Public Access Alternative B4 proposes to accommodate 175 cars, rather than 275 cars as the commenter suggests. This is the same number of spaces that exist currently.

Response to Comment V-4

NPS evaluated the remnants of the tavern and concluded they do not have sufficient integrity to warrant protection as a historic resource. In response to public interest, NPS will change proposed actions slightly and will leave the tavern's chimney in place. The buried retaining wall will be removed because it affects the functioning of the wetland.

W

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Correspondence Information

Status: New	**Park Correspondence Log:**
Date Sent: 03/06/2007	**Date Received:** 03/06/2007
Number of Signatures: 1	**Form Letter:** No
Contains Request(s): No	**Type:** Web Form
Notes:	

Dear Superintendent O'Neill,

Thank you for the opportunity to comment on the DRAFT EIS/EIR for the Wetland and Creek Restoration at Big Lagoon, Muir Beach, Marin County California. I have lived at 190 Pacific Way -approximately thirty yards from the entrance to Muir Beach- continuously for the last twenty-three years, and have witnessed the extreme changes to the lower Redwood Creek and Muir Beach landscape, during that time. I certainly welcome action to restore the area. On the whole, the Preferred Alternatives summarized in the report are both acceptable and beneficial. There are two aspects of the plan on which I wish to comment and that I respectfully ask be given due consideration.

1. Public Access Alternative - Parking Lot. The Preferred Alternative B3 implies that simply relocating the parking lot northward will provide sufficient flow in the lower reach of Redwood Creek, which when combined with the other aspects of the restoration plan, will reduce the likelihood of upstream flooding. This implication is incorrect, and does not account for the hydrologic effect of the height of the parking lot. Years ago, before the NPS added fill to raise the height of the parking lot approximately four feet, the parking lot would flood when there was a combination of high tides, storm surge, and heavy runoff from rains. During these events, flooding of Pacific Way never occurred. Flooding began on Pacific Way the first winter after the parking lot was raised, and has continued to occur at least once every year since. The evidence is very strong that the mere presence of the parking lot is not as much an issue as its height. The assumption in the DRAFT plan that placing the parking lot a minimum distance of 180 feet from the creek will be sufficient. However, unless the level of the parking lot is reduced from its current height and instead reduced to the approximate level of the surrounding land, then the parking lot will continue to be a barrier that causes upstream flooding. Since the parking lot would not be useable during heavy storm events anyway -flooding on Pacific Way would block access to the parking lot, and the NPS would keep Muir Beach closed to prevent danger to the public from high surf and flooding on the beach- there is no public benefit to keeping the parking lot at its existing raised height. The plan should specifically state that the height of the parking lot should be lowered. W-1

2. Interpretive Displays. All alternatives assume installations of "interpretive displays". The NPS has already installed too many "interpretive displays" and signs at Muir Beach and the surrounding trails. Over the last 23 years, my family and I have hosted visitors from all over the U.S., as well as dozens of people from other countries. Visitors often comment on the excessive signage on NPS property. Visitors from other countries such as Norway, Switzerland, Kuala Lumpur, Australia, Italy, and the United Kingdom have all commented that the displays and signage are distracting and that they detract from their enjoyment of the environment. I too find the signage has become excessive, and do not believe any more are necessary or desirable, especially as part of this project. W-2

Thank you for the opportunity to comment on the Draft EIS/EIR for this project. I look forward to the day that restoration of Muir Beach Wetlands and Redwood Creek actually begins.

Sincerely,

Christian Riehl

Letter W: Christian Riehl (March 6, 2007)

Response to Comment W-1

The existing parking lot is approximately 450 feet long, and the lower picnic area is an additional 60 feet long. The parking lot elevations slope from approximately 10.5 feet NGVD on the northwestern end to 13 feet at the southeastern end (adjacent to former picnic area). The high point in the parking lot is the earth berm that separates the two parking stall lanes; this ridge slopes from approximately 12.5 feet NGVD to 14 feet NGVD (northwest to southwest). Adjacent wetlands beachward of the parking lot are approximately 7 to 9 feet NGVD.

We agree that the height (i.e., elevation) of the parking lot affects the flooding levels. As part of the *Feasibility Study* (PWA et al. 2003), hydraulic modeling was used to help examine the effects of the parking lot on flood levels. In a hydraulic model, the parking lot elevation was lowered approximately 3 feet on the southeastern end to elevation 10 feet NGVD.

We used the hydraulic model to test the sensitivity of parking-lot height on flood levels. We performed model runs for the 5- and 50-year flow events and varied the setback distance of the lowered parking lot by 30, 60, 90, and 300 feet (westward from the creek). Under the 5-year event, water levels dropped 0.5, 0.7, and 0.9 feet at setback distances of 30, 90, and 300 feet, respectively. Under these conditions, lowering approximately 90 feet of the raised area at the southeastern end of the existing parking lot could reduce the backwater effect by 0.7 feet; only a modest incremental decrease in flood elevations (0.2 feet) would be achieved from setting the parking lot back 200 feet farther.

The preferred alternative (Public Access Alternative B4) includes a reconfigured parking lot setback approximately 350 feet from the creek bank. Based on results of the hydraulic model, as well as informed opinions of geomorphologists who are cognizant of the effects of rare, but large events, NPS believes the rotated parking lot will fully achieve the protection the commenter seeks. NPS did consider lowering the new parking lot, even though we are confident that pulling it away from the creek alone would achieve the needed area for high flows to pass. The new parking lot would remain inundated under large flood events (such as Q50 and larger). If the parking lot elevation were lowered, it would be inundated more frequently due to creek flooding and/or storm surge, thereby increasing maintenance needs. NPS is choosing to keep the parking lot at about its existing elevation to minimize parking lot maintenance needs. (The exact elevation of the parking lot will be selected during the detailed design phase based on more refined hydraulic analysis.)

Response to Comment W-2

NPS appreciates the commenter's input and concern for the area's natural values. Residents of Green Gulch Farm and the Muir Beach community also have

expressed a preference that the beach remain relatively free of signage so that users can experience the area's natural qualities with a minimum of distraction. On the other hand, public surveys conducted by the Golden Gate National Parks Association have shown that visitors want more information about park resources, recreational opportunities, and trail routes.

NPS intends to balance these two interests by creating a cohesive signage/interpretation plan that provides pertinent information but does not alter the rural, semi-wild character of the area. This approach follows NPS policy 9.3.1.1 that signs

> will be held to the minimum number, size and wording required to serve their intended functions and to minimally intrude upon the natural and historic settings. They will be placed where they do not interfere with park visitors' enjoyment and appreciation of park resources.

The signage plan will be developed during the design phase of the project, following the completion of the Final EIS/EIR.

X

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Correspondence Information

Status: New	**Park Correspondence Log:**
Date Sent: 01/08/2007	**Date Received:** 01/08/2007
Number of Signatures: 1	**Form Letter:** No
Contains Request(s): No	**Type:** Web Form
Notes:	

I will be brief. Muir Beach is a beautiful and important community beach area. I believe it is important to keep the public parking spaces at or near the existing parking location. I believe it is important to keep many parking spaces to allow easy access for 'everyday' people and families. I suggest one hundred spaces as a general number. If parking is further away from the existing location, or very limited in number, this Muir Beach area will become an exclusive area for environmental specialists of various sorts. (There are many, many other beautiful more secluded beach areas that are available to environmental specialists.) Also, by limiting parking to this beach, the GGNRA risks inadvertently creating a parking hazard on or near Highway One. Muir Beach is a wonderful, wonderful place, and I wish to guarantee access to the everyday working man and families as there has always been. Aside from making this point about beach access, I would like to comment that restoration of the creek outflow area is a great project. X-1

Letter X: Edward T. Sanford (January 8, 2007)

Response to Comment X-1

As discussed in the Final EIS/EIR, Public Access Alternative B4 is now the preferred alternative. Public Access Alternative B4 was determined to be the best option to balance multiple project objectives while avoiding or minimizing environmental impacts. Public Access Alternative B4 would provide the same number of spaces as the existing parking lot and includes 310 linear feet of stacking room for cars between the entrance and the first parking stall. This alternative will allow improved floodplain functioning and habitat enhancement.

Y

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Status: New	**Park Correspondence Log:**
Date Sent: 03/06/2007	**Date Received:** 03/06/2007
Number of Signatures: 1	**Form Letter:** No
Contains Request(s): No	**Type:** Web Form
Notes:	

Despite references to a 5 year and 50 year planning horizon, TRANSDEF was unable to find any analysis of impacts for those years. Under CEQA, the EIR is required to evaluate reasonably foreseeable developments, which would include changes in future park patronage. Given that future demand for park facilities has already been evaluated as part of the Comprehensive Traffic Management Plan, it would be unreasonable for the EIR to be limited to a study of existing conditions only when future projections of use are available. Because the Proposed Project is intended to serve the public for the distant forseeable future, the EIR should include a section that demonstrates successful methods for coping with future increases in visitorship, even if they are not implemented
immediately. Y-1

Because the Proposed Project is likely to make Muir Beach a more attractive destination, the following statement in the Air Quality section (p. 4-80.) is unacceptable, making the analysis inadequate: "This Draft EIS/EIR assumes that the project would not result in changes in visitation to Muir Beach." Y-2

The selection of the environmentally superior alternative must not be allowed to be made on the basis of short term parking adquacy. Only an appropriately long term view will be able to adquately determine the optimal size for the parking area for the proposed project. Y-3

Furthermore, the assumption that there is no illegal parking in response to overflow conditions is also unreasonable. This is an impact that should be studied rather than being merely assumed away. Y-4

The year studied was not identified in the title for Tables 4.3.4.2-3, -4, -5, -6, and -7. The title should indicate Existing Conditions. Y-5

Excess parking demand identified in Impacts TC-P6, TC-P7, TC-P8, and TC-P9 was not adquately mitigated. The EIR should study a mitigation package composed of 1). enforcement of local illegal overflow parking; 2). parking charges, high enough to reduce parking demand; and 3). an expansion of the Muir Woods Shuttle system to Muir Beach. The EIR should evaluate the performance of this mitigation package over the longer planning horizons to see whether it can accomodate more park users while
reducing traffic congestion and associated auto air emissions and noise (Impact NZ-P3). The consistency of these results with the relevant policy documents (NPS Management Policies, Marin Countywide Plan and Redwood Creek Watershed Vision for the Future) should also be evaluated. Y-6

The EIR should carry an alternative that explicitly complies with the NPS Parking Policy, so that the Policy's impacts can be thoroughly evaluated. In TRANSDEF's opinion, the Parking Policy is seriously outmoded, and Y-7

should not be considered a threshold test for environmental impacts. It fails to consider impacts of parking lots on environmental
resource values of the Park sites it pertains to, and fails to recognize the benefits of Transportation Demand Management in reducing the cumulative environmental impacts of visitor travel. Y-7 cont.

Please note that the section on Energy use ignores the transportation component of energy use. By reducing vehicular travel to the Park, the project could reduce Impact PS-R2. Fossil fuels used in transportation are a non-renewable resource used in an inefficient manner. Y-8

Letter Y: David Schonbrunn (March 6, 2007)

Response to Comment Y-1

As part of the CTMP, projected (2023) parking demand at Muir Beach was estimated as follows (existing demand has been included for reference).

Table 6-4. Projected 2023 Parking Demand at Muir Beach

	Peak Season		Shoulder Season		Off Season	
	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend
Existing parking demand	159	**201**	115	160	30	120
Projected parking demand (2023)	**210**	**260**	145	**200**	50	175

Bold = demand exceeds number of available spaces.

Source: CTMP, unpublished data.

Future increases in parking demand would result in exceeding parking capacity more frequently than under existing conditions. Other ancillary effects would increase over time also, such as the frequency and extent of vehicle queuing; LOS and intersection delay; and risks to pedestrians, equestrians, and bicyclists. As is the case in the near term, these effects would be more severe for smaller parking lots.

NPS was aware of the CTMP's projection of increased demand in the future but chose not to increase the size of the parking lot to meet that demand in order to avoid increased traffic impacts and increased impacts on resources. The commenter makes an argument that the EIS/EIR should demonstrate a method for coping with future increases in visitors. Various parking-lot sizes were considered, one of which would meet current peak-season weekend demand and none of which would meet projected peak-season weekend demand. The maximum size of any parking lot alternative was determined through the use of a hydraulic model to outline an area where parking lot fill would not increase upstream flood elevations. While it would have been possible to increase the capacity of the parking lot slightly (Public Access Alternative B5), the EIS/EIR analyses showed this would increase traffic impacts under the existing condition, regardless of what the future projections are. It is important to note that future increases in parking demand are not a result of the project, but rather an environment in which the project would exist. The preferred alternative does not change parking capacity, so future conditions would be the same whether or not the project were implemented. The project will remedy the impact of parking on natural creek function without increasing traffic impacts.

Finally, projections of parking and visitor demand could change in the future as a result of increases in public transportation, alternative modes of transportation, changed demographics leading to alterations in parking demand, use of Intelligent Transportation Systems (ITS), and other factors that remain speculative. For instance, when the County and Caltrans develop a bus stop on

Hwy 1, some added visitors may reach the site via the Muir Woods shuttle. The project does anticipate this by planning a trail along Pacific Way that will improve the experience and reduce conflicts with vehicles on the road. An improved multi-use trail connection that would result from the proposed Dias Ridge Trail recontouring and rerouting would improve access by methods other than auto. NPS may address other issues related to increased visitor demand over time outside the context of this proposed project. The Draft EIS/EIR provides an adequate analysis of existing and future traffic impacts for the purposes of disclosure, decision-making, and selection of a preferred alternative in the context of the proposed project.

Response to Comment Y-2

The degree to which visitor numbers may change (either increase or decrease) as a result of the proposed project is speculative. There is no basis for determining such a change with any degree of certainty, and the comment does not provide any information that would provide such a basis. Visitor amenities at the site would remain much as they are today, with only modest improvements in condition as a result of the project and no change in parking capacity For this reason, the assumption that visitation would remain unchanged by the project has been used and remains valid for the purposes of the EIS/EIR analysis.

Response to Comment Y-3

The preferred parking-lot size was selected with consideration of a variety of factors, including both existing and future projected parking demand and the sensitivity of the project setting. Public Access Alternative B4 was determined to be the best option to balance multiple project objectives while avoiding or minimizing environmental impacts. Public Access Alternative B4 would provide the same number of spaces as the existing parking lot and includes 310 linear feet of stacking room for cars between the entrance and the first parking stall.

Response to Comment Y-4

Text in the Draft EIS/EIR, page 4-251, describing the methods used to analyze the proposed action's impacts on traffic flow and intersection delay in the project vicinity explains, "Because no data were available on the extent of illegal parking at the site during periods when parking capacity is exceeded, modeling assumed that vehicles accessing the parking lot when the lot was full would either wait for a parking space or leave the site." Illegal parking adjacent to the beach reduces the effect of overflow vehicles on nearby roadways. Because no data are available on what percentage of overflow vehicles park illegally rather than queuing for legal spaces or returning to area roads, it was not possible to make a reasonable assumption about how much reduction in traffic overflow would result from illegal parking. To ensure that the effect of reduced parking-lot size on traffic flow was not underestimated, EIS/EIR analysis assumed that all

overflow vehicles either would queue or return to area roadways rather than park illegally—this gives a conservative, "worst case" analysis of the effects of reduced beach parking on traffic flow near Muir Beach.

The conservative assumptions made in the traffic flow analysis were not intended to avoid discussion of illegal parking effects; NPS and Marin County are aware that some level of illegal parking does occur and that a reduction in parking availability at the beach would likely increase the extent of illegal parking, with corollary effects on local circulation and access. This contributed to the selection of a Public Access Alternative that maintains the existing parking lot size. The potential that a reduction in parking availability at the beach could increase illegal parking on adjacent roads was discussed under Impact TC-P1: Changes in Parking Availability During Construction (EIS/EIR page 4-258) and Impact TC-P6: Long-Term Changes in Parking Availability (EIS/EIR page 4-261).

Response to Comment Y-5

The text introducing each table has been modified in the Final EIS/EIR to clarify the date of the traffic baseline data used to construct the tables.

Response to Comment Y-6

The commenter refers to adverse impacts associated with parking lot alternatives with reduced capacity relative to existing conditions (i.e, B1, B2, and C1). Parking restrictions on roadways accessing Muir Beach are not under NPS jurisdiction; they are enforced by the Marin County Sheriff's Office. However, NPS shares the commenter's concern regarding the adverse effects of illegal parking and is committed to working with the County and local residents to address this problem; as discussed above, the potential that reduced parking availability would increase illegal parking was a key reason for the selection of a preferred Public Access Alternative that would maintain the existing size of the parking lot.

While expansion of the Muir Woods Shuttle system to Muir Beach could alleviate impacts associated with the smaller parking lot alternatives, such expansion of service is beyond the scope of this project and therefore has not been proposed as mitigation.

Response to Comment Y-7

The parking plan for this project does meet NPS Management Policy 9.2.4 for parking, which states, "Permanent parking area will not normally be sized for the peak use day, but rather for the use anticipated on the average weekend day during the peak season of use." As stated previously, the goals of this project do not include regional transportation planning, although nothing in this EIS/EIR precludes NPS addressing these issues through future planning. It is noted that

the commenter believes that NPS Management Policy 9.2.4 is outmoded. It was not used as the sole criterion for the determination of impacts. The preferred Public Access Alternative was identified to minimize impacts on natural resources while still accommodating visitors. Please refer to the analysis thresholds provided in Section 4.3.4.2 of the EIS/EIR.

Response to Comment Y-8

The project itself would not result in the reduction of vehicle trips to the site compared with existing conditions. The public demand for use of the site would not change as a result of the project. The project therefore would not create any transportation-related energy impacts requiring mitigation, and Impact PS-R2 was determined to be negligible, including consideration of the transportation component. For this reason, reductions in vehicular travel to the park were not considered for mitigation in relationship to this project.

Please note, however, that the project does not preclude future improvements to public transportation in the area and the integration of the site with those services. In the event that public transportation is provided to the site, energy demand associated with visitation to Muir Beach potentially would decline. However, this impact would not be realized without public transportation service, which is not part of the proposed project.

Letter Z: Responses to Marin County Planning Commission Hearing Comments

The following paragraphs represent summaries of all oral comments received at the Marin County Planning Commission Hearing in San Rafael, California, held on February 26, 2007; at 11 a.m. Responses to comments are provided immediately after each comment (bullets). In general, oral comments duplicated those received in writing; for this reason, most of the responses refer the reader to the responses prepared to relevant written comments.

Comment and Response Z-1

Comments were received regarding the preference for selection of Bridge Alternative BR-4, the longest bridge alternative, as the preferred alternative.

- Please refer to MR-1 Preferred Bridge Alternative.

Comment and Response Z-2

Concern was expressed regarding the width and aesthetic appearance of the proposed bridge. Commenters are concerned that the bridge would be too wide and not blend in with the rustic character of the area. A request was made for more details on how the bridge width was estimated.

- Please refer to MR-1 and Response to Comment F-7.

Comment and Response Z-3

More information was requested on the Value Analysis and cost estimates conducted for determination of the Preferred Alternative.

- Please refer to MR-1 Preferred Bridge Alternative.

Comment and Response Z-4

Numerous comments were received regarding accommodation of alternative means of transport to the project site, such as local bus service, to reduce congestion on Pacific Way. Commenters expressed the desire for the parking lot size to be reduced to allow for a bus stop and transit service to be included in the proposed project.

- Please refer to Responses to Comments C-4, C-6, F-20, and J-1.

Comment and Response Z-5

Comments were received regarding the parking lot design and concerns over the orientation of the parking lot relative to the creek. Preference for Public Access Alternative C was expressed.

- Please refer to Responses to Comments C-7, J-2, and W-1.

Comment and Response Z-6

Comments were received regarding provisions for separate pedestrian access to the beach and parking lot. A separate pedestrian bridge was also proposed.

- Please refer to Response to Comment N-17.

Comment and Response Z-7

A comment was received about the impact of sea level rise on the frequency and depth of flooding over the bridge.

- Please refer to MR-3 Sea Level Rise.

Comment and Response Z-8

A comment was received regarding riparian restoration and the level of protection that would be provided for salmon refugia and rearing habitat.

- Please refer to MR-2 Salmonid Rearing Habitat.

Comment and Response Z-9

Preference was expressed for selection of the alternatives that would restore the most geomorphic functions of the creek and result in the least amount of fill in the floodplain.

- The commenter's preference is noted. The preferred alternative is anticipated to result in substantial improvement to the geomorphic functioning of Redwood Creek while minimizing the amount of net fill to the floodplain.

Comment and Response Z-10

Commenters requested that signage for the proposed project include regional history about the area and encourage alternative transport to the project site.

- Please refer to Responses to Comments L-7 and W-2.

Comment and Response Z-11

Consideration of population growth estimates and the potential impact on visitor use and traffic at the proposed project site was requested.

- Increases in population, Muir Beach visitation, and associated vehicle traffic were considered in preparation of the EIS/EIR. However, because these are not consequences of the project or its alternatives, their potential impacts were not evaluated. Although the goals of the project do not include addressing increased visitation to Muir Beach, the project would create conditions that are as good or better than existing conditions with respect to accommodation of visitors (such as construction of a new Pacific Way bridge that accommodates two-way traffic and construction of a separate pedestrian trail). Further, the proposed project would not preclude future actions to address increases in visitation over time.

Chapter 7

Consultation and Coordination

This chapter provides an overview of the history of public involvement, consultation, and other requirements for the proposed Big Lagoon project, as well as describes the progress made in meeting those requirements. It also provides a list of preparers and a list of Final EIS/EIR recipients.

History of Public Involvement

Between December 2002 and December 2004, 17 public meetings were held, as well as a variety of site visits and meetings with representatives of various agencies. On December 3, 2002, a NOI to prepare an Environmental Impact Statement was published in the Federal Register, beginning the formal scoping process for the project. The NOI identified goals for the project, and public scoping meetings were held on October 22, October 29, and November 2, 2002, with a site visit for the public held on November 9, 2002, to solicit input on the project and its potential impacts. Following these meetings, a Big Lagoon Working Group consisting of interested individuals, agencies, and organizations was formed to help develop project alternatives. The working group convened regularly in meetings that were open to the public. In addition, two alternatives workshops were held for the public on September 30 and October 4, 2003. The results of those workshops, as well as a more detailed summary of the scoping process, are presented in the Alternatives Public Workshops Report (National Park Service 2004). Marin County circulated a Notice of Preparation of an Environmental Impact Report on April 27, 2004, soliciting comments on the specific issues to be included in the scope of CEQA environmental review. All of these activities informed the alternatives formulation process.

Following release of the Draft EIS/EIR, NPS and Marin County held two public meetings to present the project to interested parties and to answer questions about the project. These meetings were held on January 18 and 31, 2007. NPS and Marin County also conducted a public hearing at the Marin County Planning Commission in San Rafael, California, on February 26, 2007, to receive comments on the draft document.

Compliance Status

Documentation of NPS compliance with federal and state laws and regulations is incorporated into the text of the Final EIS/EIR. Compliance with ten of the major federal laws, executive orders, and associated state regulations is summarized here.

National Environmental Policy Act (NEPA) of 1970 (PL 91-190, 83 Stat. 852, 42 USC §4341 et seq.)

The Final EIS/EIR provides disclosure of the planning and potential environmental consequences of the proposed action and alternatives, as required by NEPA. A Notice of Availability for the Draft EIS/EIR was published in the Federal Register and the document made available for public review and comment. The NPS also provided the Notice of Availability of the Draft EIS/EIR through a direct mailing and posting on the park's web site. The Draft EIS/EIR was made available for review at park headquarters, park visitor centers, local and regional libraries, and on the park's web site. The comment period extended for 75 days from the date of EPA's notice of filing published in the Federal Register. A public hearing to receive comments on the Draft EIR/EIR was held on February 26, 2007, at the Marin County Planning Commission in San Rafael, California. The Final EIS/EIR was filed with the EPA's Office of Federal Activities, and a notice was published in the Federal Register. Public review of the Final EIS/EIR will continue for 45 days from the date of EPA's notice of filing published in the Federal Register.

Endangered Species Act of 1973 As Amended (PL 93-205, 87 Stat. 884, 16 USC §1531 et seq.)

The Endangered Species Act protects threatened and endangered species, as listed by the U.S. Fish and Wildlife Service (USFWS), from unauthorized take, and directs federal agencies to ensure that their actions do not jeopardize the continued existence of listed species. Section 7 of the act defines federal agency responsibilities for consultation with the USFWS and NMFS and requires preparation of a Biological Assessment to identify any threatened or endangered species that are likely to be affected by the proposed action. Species occurring on the project site that are listed as threatened under the federal ESA include coho salmon, steelhead, and CRLF. One other listed species has been observed at the project site, California brown pelican (federally endangered).

The NPS has engaged in informal consultation with the USFWS and NMFS throughout in the project planning process. Upon request, the USFWS sent the NPS a species list for the Big Lagoon site. NMFS sent a list of threatened and endangered fish under its jurisdiction that may be affected by the project. These

lists include plant and animal species that may occur within, or be affected by activities within, the project area.

Formal consultation with USFWS and NMFS will begin concurrent with ~~following completion of~~ the public comment period on the Final EIS/EIR, and will be completed concurrent with the preparation of the ROD.

The Magnuson-Stevens Fishery Conservation and Management Act As Amended by the Sustainable Fisheries Act of 1996 (PL 104-267)

This requires all federal agencies to consult with NMFS on all actions or proposed actions permitted, funded, or undertaken by the agency that may adversely affect Essential Fish Habitat (EFH). NMFS would provide recommendations to conserve EFH to federal or state agencies for activities that would adversely affect EFH. Consultation with NMFS is still underway and will be completed concurrent with the preparation of the Record of Decision. Redwood Creek is designated as EFH for coho salmon.

Section 404 of the Clean Water Act (33 USC 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403)

All proposed work and/or structures extending bayward or seaward of the line on shore reached by (1) mean high water in tidal water, or (2) ordinary high water in nontidal waters designated as navigable water of the United States must be authorized by USACE pursuant to Section 10 of the Rivers and Harbors Act. Section 404 of the Clean Water Act establishes a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. The permit process with the Corps has formally begun, but will be completed concurrent with the preparation of the Record of Decision. As discussed elsewhere, most of the project site is considered jurisdictional.

Archeological Resources Protection Act of 1979 (PL 96-95, 93 Stat. 712, 16 USC §470aa et seq. and 43 CFR 7, subparts A and B, 36 CFR)

This act secures the protection of archeological resources on public or American Indian lands and fosters increased cooperation and exchange of information among the private, government, and professional community in order to facilitate the enforcement and education of present and future generations. It regulates excavation and collection on public and American Indian lands. It requires

notification of American Indian tribes who may consider a site of religious or cultural importance prior to issuing a permit. The NPS will meet its obligations under this act in all activities proposed as part of the Big Lagoon project.

National Historic Preservation Act of 1966 As Amended (PL 89-665, 80 Stat. 915, 16 USC §470 et seq. and 36 CFR 18, 60, 61, 63, 68, 79, 800)

36 CFR 800 is the set of regulations through which Section 106 is implemented. Section 106 of the National Historic Preservation Act requires that agencies evaluate potentially historic properties for their eligibility for listing in the National Register of Historic Places and take into account the effects of the undertakings on properties listed in or eligible for listing in the National Register of Historic Places. The NPS has developed a Programmatic Agreement in consultation with the California State Historic Preservation Officer (SHPO) under which NPS has conducted identification of historic properties for the proposed undertaking and subsequently shares the findings with SHPO.

Under the Programmatic Agreement, the NPS can comply with Section 106 without SHPO consultation when no historic properties are adversely affected and there is therefore no impact. For the proposed undertaking, NPS will develop a Finding of Effect document under its 1992 Programmatic Agreement or according to the regulations set forth in 36 CFR 800 and submit it to SHPO for concurrence.

NPS has consulted with SHPO on an ongoing basis regarding historic properties at the project site, and will complete historic property identification efforts as well as the Finding of Effect document prior to filing of the ROD.

Native American Graves Protection and Repatriation Act Compliance

This project will require compliance with the Native American Graves Protection and Repatriation Act (NAGPRA). NAGPRA specifies the procedures that federal agencies must follow when burials of Native American origin are found on federal land (43 CFR, Part 10, Subpart B, Section 10.4). The NPS has responsibility for complying with NAGPRA for all areas within the area of potential effect (APE).

If human remains of Native American origin are discovered within the APE during archaeological excavation or during construction-related ground-disturbing activities, the following provisions will be followed to comply with NAGPRA regulations:

- Notify, in writing, the responsible federal agency, and

- Cease activity in the area of discovery and protect the human remains.

Upon notification that human remains have been discovered on federal land, NAGPRA requires that the responsible federal agencies:

- Certify receipt of the notification;
- Take steps to secure and protect the remains;
- Notify the Native American tribes or tribes likely to be culturally affiliated with the discovered human remains within 1 working day; and
- Initiate consultation with the Native American tribe or tribes in accordance with regulations described in 43 CFR, Part 10, Subpart B, Section 10.5.

If Native American human remains are encountered during excavation in the APE, work in the vicinity of the remains will halt immediately. The ultimate disposition of the remains will be determined in consultation with Native American representatives.

American Indian Religious Freedom Act (PL 95-341, 92 Stat. 469, 42 USC §1996)

This act declares policy to protect and preserve the inherent and constitutional right of the American Indian, Eskimo, Aleut, and Native Hawaiian people to believe, express, and exercise their traditional religions. It provides that religious concerns should be accommodated or addressed under NEPA or other appropriate statutes.

Executive Order 11988: Floodplain Management

This executive order requires federal agencies to avoid, to the extent possible, adverse impacts associated with the occupancy and modification of floodplains, and to avoid development in floodplains whenever there is a practical alternative. If a proposed action is found to be in the applicable regulatory floodplain, the agency shall prepare a floodplain assessment, known as a Statement of Findings. All of the actions evaluated in the Big Lagoon Final EIS/EIR are consistent with this executive order.

Executive Order 11990: Protection of Wetlands

This executive order established the protection of wetlands and riparian systems as the official policy of the federal government. It requires all federal agencies to consider wetland protection as an important part of their policies; to take action to minimize the destruction, loss, or degradation of wetlands; and to preserve and enhance the natural and beneficial values of wetlands. All of the actions

evaluated in the Big Lagoon Final EIS/EIR are consistent with this executive order.

Executive Order 13112: Invasive Species

This executive order prevents the introduction of invasive species and directs federal agencies not to authorize, fund, or carry out actions that they believe are likely to cause or promote the introduction or spread of invasive species. Actions evaluated in the Big Lagoon Final EIS/EIR include measures to prevent the introduction and spread of invasive species.

California Coastal Zone Management Act

This act protects coastal environments. While the act transferred regulatory authority to the states and excluded federal installations from the definition of the "coastal zone," it requires that federal actions be consistent with state coastal management plans. Activities taking place within the coastal zone under the definition established by the California Coastal Management Plan require a federal consistency determination. The Final EIS/EIR will be submitted to the California Coastal Commission for federal consistency determination. Actions taken by Marin County, and possibly federal actions on lands in private, local or state ownership, will need to apply for a coastal development permit.

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A Final EIS/EIR will be sent to any agency, organization, or individual that provided a substantive comment on the Draft EIS/EIR, or to anyone who requests a copy. Notification that the Final EIS/EIR is available will be widely publicized. Limited printed paper copies will be available for distribution; however, paper copies will be available for review at the lead agencies offices or in local libraries. A complete list of Final EIS/EIR recipients is available from the issuing office.

Chapter 8
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Glossary of Terms

Action alternative

Project alternative that includes activities that would result in physical changes to the environment.

Anadromous

Fish that migrate up rivers from the sea to breed and spawn in fresh water.

Anthropogenic

Derived from human activities, as opposed to effects or processes that occur in the natural environment without human influences.

Avulsion

A sudden abandonment of an existing stream channel.

Backbeach

The region of a beach that extends from the highest elevation of the beach landward to the edge of the dunes, defined as the edge of permanent vegetation.

CEQA Process

The objective analysis of a proposal to determine the degree of its environmental impacts on the human environment, alternatives and mitigation that reduce those impacts, and the full and candid presentation of the analysis to, and involvement of, the interested and affected public.

Cultural resources

Aspects of a cultural system that are valued by or significantly representative of a culture or that contain significant information about a culture.

Cumulative actions

Actions that, when viewed with other actions in the past, the present, or the reasonably foreseeable future, regardless of who has undertaken or will undertake them, have an additive impact on the resource the proposal would affect.

Cumulative impact

Two or more environmental effects that, when considered together, are considerable or that compound or increase other environmental impacts.

Density

The number of individuals, usually by species, per unit area.

Glossary of Terms (continued)

Direct effect

An impact that occurs as a result of the proposal or alternative in the same place and at the same time as the action.

Environmental impact report (EIR)

A detailed CEQA document that is prepared when a proposal or alternatives have the potential for significant impact on the human environment.

Environmental impact statement (EIS)

A detailed NEPA document that is prepared when a proposal or alternatives have the potential for significant impact on the human environment.

Environmentally preferred alternative

Of the alternatives analyzed, the one that would best promote the policies in NEPA Section 101. This is usually selected by the interdisciplinary team (IOT) members. It is presented in the NPS NEPA document (draft and final EIS or EA) for public review and comment.

Eutrophication

The process by which a body of water becomes enriched in dissolved nutrients (such as phosphates), stimulating the growth of aquatic plant life, which usually results in the depletion of dissolved oxygen.

Facultative species

Species that can occur both in wetland and upland habitat.

Gabion

A basket or cage filled with earth or rocks and used especially in building a support or abutment.

Genotype

The genetic makeup, as distinguished from the physical appearance, of an organism or a group of organisms.

Grade Separated

Topographically separated; in the case of the pedestrian bridge, it would be one or more feet higher or lower than the roadway.

Glossary of Terms (continued)

Human environment

Defined by CEQ as the natural and physical environment, and the relationship of people with that environment (1508.14). Although the socioeconomic environment receives less emphasis than the physical or natural environment in the CEQ regulations, the NPS considers it to be an integral part of the human environment.

Impact topics

Specific natural, cultural, or socioeconomic resources that would be affected by the proposed action or alternatives (including no action). The magnitude, duration, and timing of the effect on each of these resources is evaluated in the impact section of an EA or an EIS.

Indirect impact

Reasonably foreseeable impacts that occur removed in time or space from the proposed action. These are "downstream" impacts, future impacts, or the impacts of reasonably expected connected actions (e.g., growth of an area after a highway to it is complete).

Interannual

Occurring between or semi-annually, i.e., from year to year.

Invasive Species

Species that reproduce aggressively, that are typically nonnative (i.e., do not naturally occur) to an ecosystem under consideration, and that cause or are likely to cause economic or environmental harm or harm to human health.

Issues

In NEPA, issues are environmental, social, and economic problems or effects that may occur if the proposed action or alternatives (including no action) are implemented or continue to be implemented.

Lead agency

The agency either preparing or taking primary responsibility for preparing the NEPA document.

Mainstem

The main river channel of the river system into which tributaries flow.

Glossary of Terms (continued)

Major federal action

Actions that have a large federal presence and that have the potential for significant impacts on the human environment. They include adopting policy; implementing ru1es or regulations; adopting plans, programs, or projects; ongoing activities; issuing permits; or financing projects completed by another entity.

Manning's n

Manning's Roughness Coefficient. Usually notated as "***n***," this unitless coefficient is used in hydraulic modeling to identify the "roughness" of an area, or its resistance to passing flow. A high ***n*** value means increased roughness. For example, a concrete channel would have a relatively low ***n*** value, whereas a stream channel with dense willow growth would have a relatively high ***n*** value.

Mitigation

A modification of the proposal or alternative that lessens the intensity of its impact on a particular resource.

National Geodetic Vertical Datum (NGVD)

A fixed surface reference established by the U.S. Coast and Geodetic Survey to which relief features and elevation data are referenced.

NEPA process

The objective analysis of a proposal to determine the degree of its environmental and interrelated social and economic impacts on the human environment, alternatives and mitigation that reduce those impacts, and the full and candid presentation of the analysis to, and involvement of, the interested and affected public.

No-Action Alternative

Project alternative that would result in no project being implemented.

Notices of Availability

Separate notices submitted to the Federal Register that the draft EIS and the final EIS are ready for distribution.

Glossary of Terms (continued)

Notice of Intent (NOI)

The notice submitted to the Federal Register indicating that an EIS will be prepared. It describes the proposed action and alternatives, identifies a contact person at the NPS, and gives time, place, and descriptive details of the agency's scoping process.

Notice of Preparation (NOP)

Notice to public agencies of an intent to prepare an environmental impact report.

Obligate wetland species

Species that occur primarily in wetland habitat.

Off-Peak Season

Time period during which a recreational or tourist area received the least number of visitors.

Peak Season

Time period during which a recreational or tourist area received the greatest number of visitors.

Phenological

The scientific study of periodic biological phenomena, such as flowering, breeding, and migration, in relation to climatic conditions.

Preferred alternative

The alternative an NPS decision maker has identified as preferred at the draft EIS or EA stage. Identification of the preferred alternative helps the public focus its comments during review of the NEPA document.

Q

Q is the recurrence interval (in years) of a given flow event. The recurrence interval (sometimes called the return period) is based on the probability that the given event will be equaled or exceeded in any given year. For example, a Q1 event is the 1-year recurrence interval event, or the event that has a 100% probability of occurring in any given year. A Q2 event has a 50% probability, a Q50 event has a 2% probability, and a Q100 event has a 1% probability of occurring in any given year.

Proposal

The stage at which the NPS has a goal and is preparing to make a decision on one or more alternative means of accomplishing that goal. The goal can be a project, plan, policy, program, and so forth. The NEPA process begins when the effects can be meaningfully evaluated.

Record of Decision (ROD)

The document that is prepared to substantiate a decision based on an EIS. It includes a statement of the decision made, a detailed discussion of decision rationale, and the reasons for not adopting all mitigation measures analyzed, if applicable.

Refugia

An area that has escaped ecological changes occurring elsewhere and so provides a suitable habitat for species.

Revegetation

Plant stock that is germinated and grown in one location, and then planted at another site.

Riparian

Relating to, or living or located on the banks of a river or stream.

Salmonid

Of, belonging to, or characteristic of the family *Salmonidae*, which includes the salmon, trout, and whitefish.

Scoping

Internal NPS decision making on issues, alternatives, mitigation measures, the analysis boundary, appropriate level of documentation, lead and cooperating agency roles, available references and guidance, defining purpose and need, and so forth. External scoping is the early involvement of the interested and affected public.

Shoulder Seasons

The time periods between a recreational area's peak season and off-peak season, when the recreational area receives an intermediate level of use, typically occurring in fall and spring.

Soffitt

The underside of a structural component, such as a bridge.

Special-status species

For purposes of this EIS/EIR, any species listed or proposed for listing under the state or federal endangered species acts, or recognized as locally rare by recognized authorities.

Tiering

The use of broader, programmatic NEPA documents to discuss and analyze cumulative regional impacts and define policy direction, and the incorporation by reference of this material in subsequent narrower NEPA documents to avoid duplication and focus on issues "ripe for decision" in each case.

Glossary of Terms (continued)

Thalweg

The line defining the lowest points along the length of a river bed or valley.

Tributary

A smaller river or stream that flows into a larger river or stream.

Watershed

The area from which water drains to a single point or body of water; also called drainage basin.

Wetland

An area that floods periodically, has waterlogged soils, or is covered with a relatively shallow later of fresh or saltwater.

Exhibit 2: Final Environmental Impact Statement

Species List: Common and Scientific Names

Common Name	Scientific Name
Invertebrates	
California freshwater shrimp	*Syncaris pacifica*
Monarch butterfly	*Danaus plexxippus*
Myrtle's silverspot butterfly	*Speyeria zerene myrtlaeae*
Ricksecker's water scavenger beetle	*Hydrochara rickseckeri*
San Francisco fork-tailed damselfly	*Ischnura gemina*.
silverspot butterfly	*Speyeria zerene myrtleae*
Fish	
coast range sculpin	*Cottus aleuticus*
coho salmon	*Oncorhynchus kisutch*
Pacific staghorn sculpin	*Leptocottus armatus*
prickly sculpin	*Cottus asper*
riffle sculpin	*Cottus gulosus*
Sacramento blackfish	*Orthodon microlepidotus*
Sacramento perch	*Archoplites interruptus*
Sacramento pikeminnow	*Ptchocheilus grandis*
starry flounder	*Platichthys stellatus*
steelhead trout	*Oncorhynchus mykiss*
striped bass	*Morone saxatilis*
threespine stickleback	*Gasterosteus aculeatus*
tidewater goby	*Eucyclogobius newberryi*
topsmelt	*Atherinops affinis*
yellowfin goby	*Acanthogobius flavimanus*
Amphibians and Reptiles	
California newts	*Taricha torosa*
California red-legged frog	*Rana aurora draytonii*
ensatina	*Ensatina eschscholtzi*

Species List: Common and Scientific Names (continued)

Common Name	Scientific Name
foothill yellow-legged frog	*Rana boylii*
northern alligator lizard	*Elgaria coeruleus*,
slender salamander	*Batrachoseps attenuatus*
western aquatic garter snake	*Thamnophis couchi aquaticus*
western fence lizard	*Sceloporus occidentalis*
western pond turtle	*Emys [Clemmys] marmorata*
western terrestrial garter snake	*Thamnophis elegans*
Birds	
American goldfinch	*Caruelis tristis*
American Peregrine Falcon	*Falco peregrinus anatum*
Brewer's blackbird	*Euphagus cyanocephalus*
California brown pelican	*Pelecanus occidentalis californicus*
northern spotted owl	*Strix occidentalis caurina*
song sparrow	*Melospiza melodia*,
Swainson's thrush	*Catharus ustulatus*
Willow flycatcher	*Empidonax traillii*
Wilson's warbler	*Wilsonia pusilla*
yellow-bellied racer	*Coluber constrictor*
Mammals	
bobcat	*Lynx rufus*
brush rabbit	*Sylvilagus bachmani*
California giant salamander	*Dicamptoden ensatus*
California vole	*Microtis californicus*
Columbian black-tailed deer	*Odocoileus hemionus columbianus*
coyote	*Canis latrans*
deer mouse	*Peromyscus maniculatus*

Species List: Common and Scientific Names (continued)

Common Name	Scientific Name
gray fox	*Urocyon cinereoargeteus*
roof rat	*Rattus rattus*
striped skunk	*Mephitis mephitis*
western gray squirrels	*Sciurus griseus*
western harvest mouse	*Reithrodontomys megalotis*
Plants	
annual bluegrass	*Poa annua*
annual fescues	*Vulpia* spp.
annual grasses	*Polypogon monspeliensis*, *Lolium perenne*
arroyo willow	*Salix lasiolepis*
Baltic rush	*Juncus balticus*
beach bur	*Ambrosia chamissonis*
beach layia	*Layia carnosa*
beach wild-rye	*L. pacificus*
black cottonwood	*Populus balsamifera*
blackberry	*R. ursinus* and *R. discolor*
blue wild rye	*Elymus glaucus*
Brazilian waterweed	*Egeria densa*
bull thistle	*Cirsium vulgare*
bulrush	*Scirpus* spp.
California bee plant	*Scrophularia californica*
California bottlebrush grass	*Elymus californicus*
California buckeye	*Aesculus californica*
cape ivy	*Delairea odorata* [*Senecio mikanioides*]
cattail	*Typha* spp.
clustered dock	*Rumex conglomeratus*

Species List: Common and Scientific Names (continued)

Common Name	Scientific Name
coast redwood	*Sequoia sempervirens*
cordgrass	*Spartina*
creeping bent	*Agrostis stolonifera*
creeping bent grass	*Agrostis stolonifera*
creeping wild-rye	*L. triticoides*
cut-leaved geranium	*Geranium dissectum*
dotted smartweed	*Polygonum punctatum*
dune grass	*Leymus mollis*
elderberry	*Sambucus* spp.
English ivy	*Hedera helix*
floating marsh pennywort	*Hydrocotyle ranunculoides*
glasswort	*Salicornia* spp.
hair grass	*Aira caryophyllea*
Harding grass	*Phalaris aquatica*
hedgehog dogtail	*Cynosurus echinatus*
hedgenettle	*Stachys ajugoides*
Himalayan blackberry	*Rubus discolor*
Kikuyu grass	*Pennisetum clandestinum*
Knotgrass	*Paspalum* spp.
Lobb's water-crowfoot	*Ranunculus lobbii*
Marin knotweed	*Polygonum marinense*
monkey flower	*Mimulus guttatus*
Monterey cypress	*Cupressus macrocarpa*
Monterey pine	*Pinus radiata*
morning glories	*Calystegia* spp.
Mugwort	*Artemesia douglasiana*

Species List: Common and Scientific Names (continued)

Common Name	Scientific Name
Needle grass	*Nassella pulchra*
nettles	*Urtica dioica*
nodding semaphore grass	*Pleuropogon refractus*
ox-tongue	*Picris echioides*
panic veldt grass	*Ehrharta erecta*
pennyroyal	*Mentha pulegium*
pink sand verbena	*Abronia umbellata* ssp. *brevifolia*
plantain	*Plantago* spp.
Point Reyes bird's-beak	*Cordylanthus maritimus var. palustris*
Point Reyes lupine	*Lupinus tidestromii var. layneae*
poison hemlock	*Conium maculatum*
red alder	*Alnus rubra*
red elderberry	*Sambucus racemosa*
ripgut brome	*Bromus diandrus*
salt grass	*Distichlis spicata*
salt rush	*Juncus leseurii*
San Francisco spineflower	*Chorizanthe cuspidate*
San Francisco wallflower	*Erysimum franciscanum*
sea rocket	*Cakile maritime*
shore pine	*Pinus contorta* ssp. *contorta*
silverweed	*Potentilla anserina*
soft chess	*Bromus hordeaceous*
Sonoma alopecurus	*Alopecurus aequalis* var. *sonomensis*
spikerush	*Eleocharis macrostachya*
swamp bellflower	*Campanula californica*
tall cyperus	*Cyperus eragrostis*

Species List: Common and Scientific Names (continued)

Common Name	Scientific Name
tall fescue	*Festuca arundinaceae*
thimbleberry	*Rubus parviflorus*
three square rush	*Scirpus americanus*
Thurber's reed grass	*Calamagrostis crassiglumi*
water parsley	*Oenanthe sarmentosa*
water plantain	*Alisma plantago-aquatica*
yarrow	*Achillea millefolium*
yellow sand verbena	*Ambronia latifolia*
yellow willow	*S. lucida*

Acronyms and Abbreviations

ADA	Americans with Disabilities Act
µ/m3	micrograms per cubic meter
5X Committee	Golden Gate National Recreation Area Historic Preservation Committee
AB	Assembly Bill
ABAG	Association of Bay Area Governments
Alquist-Priolo Act	Alquist-Priolo Earthquake Fault Zoning Act
APE	area of potential effect
ARB	California Air Resources Board
BAAQMD	Bay Area Air Quality Management District
Big Lagoon Project	Wetland and Creek Restoration at Big Lagoon, Muir Beach, Marin County, California
BMP	Best Management Practice
CAA	Federal Clean Air Act
CAAA	Clean Air Act Amendments
CAAQS	California ambient air quality standard
C-AG	Coastal Agriculture Zoning Designation
Caltrans	California Department of Transportation
CCC	California Coastal Commission
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	Cubic feet per second
C-NC	Coastal Neighborhood Commercial/Mixed Use Zoning Designation
CNDDB	California Natural Diversity Database
CNEL	Community noise equivalent level
CNPS	California Native Plant Society
CO	Carbon monoxide
C-OS	Coastal Open Space Zoning Designation
County	County of Marin
Countywide Plan	Marin Countywide Plan
CRLF	California red-legged frog
C-SF	Coastal Single Family Zoning Designation
CTMP	Comprehensive Transportation Management Plan
CWA	Clean Water Act
CY	Cubic yards
dB	Decibel
DEIR	Draft Environmental Impact Report
DEIS	Draft Environmental Impact Statement
DFG	California Department of Fish and Game
DO	Dissolved oxygen
DPS	Distinct Population Segment
DTSC	California Department of Toxic Substances Control
EA	Environmental Assessment
EC	Electrical Conductivity
EFH	Essential fish habitat
ELJs	Engineered Log Jams

Acronyms and Abbreviations (Continued)

EO	Executive Order
EPA	Environmental Protection Agency
ESA	Federal Endangered Species Act
ESU	Evolutionary Significant Unit
FAF	Floodplain activation flows
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIGR	Federated Indians of the Graton Rancheria
FIRMs	Flood insurance rate maps
FMMP	Farmland Mapping and Monitoring Program
FMP	Fire Management Plan
fps	Feet per second
General Construction Permit	NPDES General Permit for Discharges of Storm Water Runoff Activity
GGNRA	Golden Gate National Recreation Area
GMP	General Management Plan
gpd	Gallons per day
HLA	Harding-Lawson and Associates
Hwy 1	Highway 1
I-580	U.S. Interstate 580
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
ITS	Intelligent Transportation System
km	kilometer
LCP	Local Coastal Program
Ldn	Day-night sound level
Leq	Equivalent continuous sound level
Lmax	Maximum sound levels
Lmin	Minimum sound levels
LOS	Level of service
LWD	Large woody debris
Lxx	Percentile-exceeded sound levels
Manning's *n*	*n*
MBCSD	Muir Beach Community Services District
MBVFD	Muir Beach Volunteer Fire Department
mg/l	Milligrams per liter
MHHW	Mean higher high water
MMWD	Marin Municipal Water District
MPM	Meyer-Peter and Muller
MSCSD	Muir Beach Community Services District
MSMAD	Marin-Sonoma Mosquito Abatement District
MVCAC	Mosquito & Vector Control Association of California
NAAQS	National ambient air quality standards
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act

Acronyms and Abbreviations (Continued)

NOAA Fisheries	National Oceanic and Atmospheric Administration's National Marine Fisheries Service
NOI	Notice of Intent
NOP	Notice of Preparation
NOX	Oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
OS	Open Space Zoning Designation
PA	Programmatic Agreement
PM10	Particulate matter 10 microns or less in diameter
PM2.5	Particulate matter 2.5 microns or less in diameter
ppd	Pounds per day
ppm	parts per million
PRBO	PRBO Conservation Science
PROPDEV-41	Marin County January 2006 Semi-Annual Proposed Development Survey
PSD	Prevention of Significant Deterioration
PWA	Philip Williams & Associates, Ltd.
Q	Recurrence interval for storm events
ROD	Record of Decision
ROG	Reactive organic gases
RWQCB	Regional Water Quality Control Board
SAM	Stable Channel Analytical Model
SCAs	Stream and Creekside Conservation Areas
SFBAAB	San Francisco Bay Area Air Basin
SFZC	San Francisco Zen Center
SHPO	California Office of Historic Preservation
SIP	State implementation plan
SWPPP	Stormwater pollution prevention plan
SWRCB	State Water Resources Control Board
TACs	Toxic air contaminants
TCPs	Traditional cultural properties
TDS	Total Dissolved Solids
TIF	Transportation intercept facility
tpy	Tons per year
UBC	Uniform Building Code
UNESCO	United Nations Educational, Scientific, and Cultural Organization
US-101	U.S. Highway 101
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
V/C	Volume to capacity
WDR	Waste Discharge Requirements

Exhibit 2: Final Environmental Impact Statement

Index of Key Words

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Appendix A

Notice of Intent, Notice of Preparation

Exhibit 2: Final Environmental Impact Statement

similarly announced in the **Federal Register**. As this is a delegated EIS, the official responsible for the final decision is the Regional Director, Pacific West Region; subsequently the official responsible for implementation would be the Superintendent, Fort Vancouver National Historic Site.

Dated: November 25, 2002.

Arthur E. Eck,

Acting Regional Director, Pacific West Region.

[FR Doc. 02–30485 Filed 12–2–02; 8:45 am]

BILLING CODE 4310–70–M

DEPARTMENT OF THE INTERIOR

National Park Service

Lake Meredith National Recreation Area and Alibates Flint Quarries National Monument, Texas

AGENCY: National Park Service, Department of the Interior.

ACTION: Notice of availability of a Record of Decision on the Final Environmental Impact Statement/Oil and Gas Management Plan for Lake Meredith National Recreation Area and Alibates Flint Quarries National Monument, Potter, Hutchinson, and Moore Counties, Texas.

SUMMARY: On September 26, 2002, the Director, Intermountain Region, approved the Record of Decision for the project. As soon as practical, the National Park Service will begin to implement the Oil and Gas Management Plan as described as the Preferred Alternative (Alternative B) contained in the FEIS issued on August 9, 2002. In the Preferred Alternative, all areas of the two NPS units would be formally designated as Special Management Areas (SMA's), and specific operating stipulations would be applied. While this alternative was not deemed to be the environmentally preferred alternative, it was determined to best accomplish the legislated purposes of the two NPS units by balancing the statutory mission of the NPS to provide long-term protection to the NPS units' resources and significance, while allowing for the exercise of rights to oil and gas not owned by the United States. It was also determined that implementation of the Preferred Alternative will not constitute an impairment of park resources and values. This course of action and two alternatives were analyzed in the Draft and Final Environmental Impact Statements. The full range of foreseeable environmental consequences was assessed, and appropriate mitigating measures identified.

The full Record of Decision includes a statement of the decision made; synopses of the alternatives considered, a description of the environmentally preferable alternative; the decision rationale used in selecting the alternative; a finding on impairment of park resources and values; a description of mitigation measures and monitoring plans that will be implemented for the selected alternative; a statement that addresses how all practical means to avoid or minimize environmental harm from the selected alternative have been adopted; and a description of public involvement in the decision-making process.

Basis for Decision

In reaching its decision to select the preferred alternative, the National Park Service considered the purposes for which the two NPS units were established, and other laws and policies that apply to lands in the units, including the Organic Act, National Environmental Policy Act, and the *NPS Management Policies.* The National Park Service also carefully considered public comments received during the planning process.

FOR FURTHER INFORMATION CONTACT: Karren Brown, Superintendent, Lake Meredith National Recreation Area and Alibates Flint Quarries National Monument, P.O. Box 1460, Fritch, TX 79036, Telephone: 806–857–3131.

SUPPLEMENTARY INFORMATION: A limited number of individual copies of the Record of Decision may be obtained from the Superintendent listed above.

Dated: September 26, 2002.

Karen Wade,

Director, Intermountain Region, National Park Service.

[FR Doc. 02–30487 Filed 12–2–02; 8:45 am]

BILLING CODE 4310–70–P

DEPARTMENT OF THE INTERIOR

National Park Service

Golden Gate National Recreation Area, Big Lagoon Wetland and Redwood Creek Restoration, Marin County, California; Notice of Intent to Prepare an Environmental Impact Statement

SUMMARY: In accordance with § 102 (2)(C) of the National Environmental Policy Act (42 U.S.C. 4321 *et. seq*), the National Park Service (NPS) is undertaking a comprehensive conservation planning and environmental impact analysis process regarding the proposed restoration/enhancement of the lower Redwood Creek watershed at Muir Beach. The purpose of the project is to restore or enhance ecological conditions and processes, reducing flooding of local infrastructure, and providing public access to the beach and restored wetland and creek. Key issues to be addressed will include habitat for fish and wildlife, ecosystem conditions and processes, effects on special status plant and animal species, hydrology, flood hazards, traffic, visitor access, and visitor experience. Notice is hereby given that a public scoping process has been initiated. The purpose of the public scoping process is to elicit public comment regarding the full spectrum of issues and concerns, a suitable range of alternatives, the nature and extent of potential environmental impacts or ecological benefits, and appropriate mitigation strategies that should be addressed in preparing a draft Environmental Impact Statement (EIS).

Background: The Big Lagoon project site is located at the mouth of the Redwood Creek watershed, which drains an 8.9-square-mile area on the southwestern slopes of Mt. Tamalpais in coastal Martin County. Approximately half of the restoration planning area is federally owned and is situated within the Golden Gate National Recreation Area (GGNRA); the remainder is owned by the San Francisco Zen Center. The project site is a popular destination in the park, receiving approximately 440,000 visitors annually. Historically this area supported a freshwater and brackish lagoon with associated permanent and seasonal wetlands, riparian forest, and beach dune communities. The entire area of Muir Beach and the adjacent lowland pastures were part of the Redwood Creek floodplain. The creek meandered across the valley floor and, during floods, deposited sediment across the floodplain area. Today, the creek has been confined and much of the floodplain eliminated due to the combined effects of road and levee construction, channeling projects, and placement of the NPS parking lot and picnic area.

Restoration Goals: The GGNRA is preparing an EIS to address possible extent of restoration and/or enhancement of natural resource values. The goals of the proposal include the following:

- Restore a functional, self-sustaining ecosystem, including wetland, aquatic, dune, upland, and riparian components.
- Develop a restoration design that: (a) Functions in the context of the watershed and other pertinent regional boundaries, (b) identifies and, to the extent possible, mitigates factors that reduce the site's full restoration

potential. Understanding of historical and current conditions and physical processes in the watershed is required to meet this objective.

- Consistent with restoring a functional ecosystem, create habitat adequate to support sustainable populations of special status species.
- Reduce flooding on Pacific Way and in the Muir Beach community on a long-term basis, and work with Marin County to ensure that vehicle access is provided to the Muir Beach community.
- Work with Comprehensive Transportation Management Plan staff to identify transportation alternatives that are consistent with ecosystem restoration.
- Provide for visitor experience, public access, and resource interpretation that are compatible with ecosystem restoration and historic preservation.
- Protect cultural resources and work with the Federated Indians of Graton Rancheria to incorporate cultural values and indigenous archaeological sites into the restoration design and site stewardship.
- Provide opportunities for public education and community-based restoration, including engaging local and broader communities in site stewardship and restoration planning.

Public Process to Date: The National Park Service drafted a preliminary Environmental Assessment (EA) for restoration measures considered for this area in 1994; however the EA process was not ever completed and no project was implemented. Since that time, the site has changed and new information has been developed. Due to the changed conditions, a new analysis of restoration options, mitigation issues, etc will be undertaken. At this time, public scoping meetings for the Big Lagoon wetlands and Redwood Creek restoration are scheduled as follows: Oct. 22, 2002 at the regular meeting of the GGNRA Citizens' Advisory Commission, Oct. 29, 2002 at the Muir Beach Community Center, and Nov. 2, 2002 at Tamalpais High School in Mill Valley. Site walk-thrus are be conducted on Nov. 9, 2002. Also, early technical scoping reviews were held on-site throughout July and August 2002 with experts of various disciplines (archaeology, biology, wetland and riparian ecology, geomorphology, and visitor access) to assist the project team in building a knowledge base on which study designs and preliminary alternatives will be formulated. To support the public process and foster ready access to information, GGNRA is developing a website for the project that will be hosted on the GGNRA Web site (*http://www.nps.gov/goga/admin/planning*). The Web site will be a key component of the public involvement strategy and will allow the public to view and retrieve planning documents, fact sheets, and meeting notices for the project. Following scoping and with continued input from the public and regulatory and resources agencies, a full range of preliminary project alternatives will be developed and evaluated. GGNRA staff anticipate a minimum of three alternatives, including the *No-Action* Alternative. An ''environmentally preferred'' alternative will be disclosed in the draft EIS.

Comments and Public Scoping: As noted above, three scoping meetings are scheduled during Fall 2002. Confirmed details on all scoping meetings will be announced through direct mailing, the project Web site, and local and regional media. Interested individuals, organizations and agencies are invited to attend these meetings to comment orally and/or provide written comments or suggestions. Interested persons may also refer to the GGNRA Web site for more information on this project. A scoping document (including applicable information from the 1994 EA) and site information will be available at the above Web site, or can be obtained by writing or telephoning the GGNRA staff person listed below. Comments, suggestions, or relevant information (or requests to be added to the project mailing list) should be sent to: Big Lagoon Wetland and Redwood Creek Restoration, Golden Gate National Recreation Area (*Attn:* Jennifer Vick, Project Manager), Building 201, Fort Mason, San Francisco, CA 94123 [Telephone (415) 561–4942]. All written comments for the scoping phase of Big Lagoon Wetland and Redwood Creek Restoration EIS must be postmarked not later than 45 days following the publication of this notice in the **Federal Register**.

All respondents are advised that individual names and addresses of persons commenting on the project EIS may be included as part of the public record. If individuals submitting comments request that their name or\and address be withheld from public disclosure, it will be honored to the extent allowable by law. Such requests must be stated prominently in the beginning of the comments. There also may be circumstances wherein the NPS will withhold a respondent's identity as allowable by law. As always: NPS will make available to public inspection all submissions from organizations or businesses and from persons identifying themselves as representatives or officials of organizations and businesses; and, anonymous comments may not be considered.

Decision Process: Availability of the draft EIS for review and written comment will be announced in the **Federal Register**, as well as through local and regional news media, the GGNRA Web site, and direct mailing to the project mailing list. At this time, the draft EIS is anticipated to be available for public review in early 2004. To ensure further opportunity to comment on the draft EIS after it is distributed, additional public meetings will be held (dates and locations to be determined). Notice of the availability of the final EIS will similarly be published in the **Federal Register**. As a delegated EIS, the official responsible for the final decision is the Regional Director, Pacific West Region; subsequently, the official responsible for implementation is the Superintendent, Golden Gate National Recreation Area.

Dated: October 9, 2002.

Jonathan B. Jarvis,

Regional Director, Pacific West Region.

[FR Doc. 02–30489 Filed 12–2–02; 8:45 am]

BILLING CODE 4310–70–P

DEPARTMENT OF THE INTERIOR

Notice of Intent to Prepare an Environmental Assessment and Notice of Public Meeting

AGENCY: National Park Service, Rock Creek Park, Washington, DC.

SUMMARY: In accordance with the National Environmental Policy Act of 1969 (NEPA) (Pub. L. 91–109 section 102(c)) and pursuant to a court order, the National Park Service (NPS) is preparing an Environmental Assessment (EA) regarding two privately owned and operated cellular communications towers located within Rock Creek Park pursuant to an NPS permit.

SUPPLEMENTARY INFORMATION: In 1998, pursuant to the Telecommunications Act of 1996, Bell Atlantic filed applications for permits to locate two cellular towers along with their associated equipment shelters within Rock Creek Park. In 1999, pursuant to NEPA, NPS prepared an EA that considered the environmental impacts of siting the two towers inside the park. After completing the EA, NPS concluded that the towers would not have a significant impact to the quality of the human environment, and issued a Finding of No Significant Impact (FONSI). Subsequently NPS issued the permits necessary for Bell Atlantic to construct and operate within Rock Creek Park one 100-foot monopole at the

NOTICE OF PREPARATION
ENIVRONMENTAL IMPACT REPORT for the GOLDEN GATE NATIONAL RECREATION AREA BIG LAGOON WETLAND AND CREEK RESTORATION MARIN COUNTY, CALIFORNIA

In accordance with the National Environmental Policy Act (NEPA) and state and local guidelines implementing the California Environmental Quality Act (CEQA), please be advised that the National Park Service (NPS) and Marin County are undertaking preparation of a joint Environmental Impact Report/Environmental Impact Statement (EIR/EIS) to evaluate alternatives for proposed restoration/enhancement of lower Redwood Creek at Muir Beach. The National Park Service (NPS) is the federal lead agency for the environmental review under NEPA and Marin County will be the lead agency pursuant to CEQA.

The purpose of the project is to restore or enhance ecological conditions and processes, reducing flooding of local infrastructure, and providing public access to the beach and restored wetland and creek. The objectives of the project are as follows:

1) Restore a functional, self-sustaining ecosystem, including wetland, aquatic and riparian components.
2) Develop a restoration design that: (i) functions in the context of the watershed and other pertinent regional boundaries, (ii) identifies and, to the extent possible, mitigates factors that reduce the site's full restoration potential. (An understanding of historical and current conditions and physical processes in the watershed is required to meet this objective.)
3) Consistent with restoring a functional ecosystem, create habitat adequate to support sustainable populations of special status species.
4) Reduce flooding on Pacific Way and in the Muir Beach Community, and work with Marin County to ensure that vehicle access is provided to the Muir Beach community.
5) Develop a visitor experience, public access, and resource interpretation strategy that is compatible with the ecosystem restoration and the NPS mission.
6) Protect cultural resources and work with the Federated Indians of Graton Rancheria to incorporate cultural values and resources into the restoration design and site stewardship and to identify indigenous archaeological sites within the project area.
7) Provide opportunities for public education and community-based restoration, including engaging local and broader communities in site stewardship and restoration planning.
8) Work with the Comprehensive Transportation Management Plan staff to identify transportation alternatives that are consistent with ecosystem restoration.

The National Park Service prepared a Preliminary Environmental Assessment (EA) for proposed restoration in this area in 1994. Since that time, the site has changed and new information has been developed (Site Analysis Report, Sept. 2003). Technical scoping meetings with experts in various resource disciplines were conducted in July and August 2002. Public scoping meetings on the project were conducted in October and November 2002. A full range of preliminary project alternatives have been developed and evaluated in conjunction with public scoping (Feasibility Analysis Report, Feb. 2004). GGNRA anticipates a minimum of three project alternatives and multiple parking lot alternatives, including the No Action Alternative, will be further evaluated in the EIR/EIS. The EIR/EIS will also identify the environmentally preferred alternative. Key issues to be addressed will include habitat for fish and wildlife, ecosystem conditions and processes, effects on special status plant and animal species, hydrology, flood hazards, traffic, visitor access, and visitor experience and residential quality of life. All final reports for this project, the 2002 public scoping comments, and minutes of monthly public meetings are available on the Big Lagoon project web site at www.nps.gov/goga/admin/planning.

To ensure that the EIR/EIS for this project is thorough and adequate, and meets the needs of all agencies reviewing it, we are soliciting additional comments on specific issues to be included in the scope of environmental review. Public comments on the issues to be evaluated in the EIR/EIS are also encouraged. A summary briefing statement of the project and mapped location of the project is on file with the office of the Marin County Community Development Agency, 3501 Civic Center Drive, Room 308, San Rafael, CA 94903-4157, and is available for public review between the hours of 8:00 a.m. to 4:00 p.m., Monday through Friday. A copy of the summary briefing statement may be obtained by calling (415) 499-6269.

Please submit your written comments to Tim Haddad, Environmental Coordinator, at the address shown above by May 27, 2004. Comments by FAX or E-mail may not be able to be confirmed as officially received and accepted before the end of the comment period deadline. Commentors are advised to mail written comments postmarked on or before May 27, 2004.

Alex Hinds
Agency Director
/s/ Tim Haddad
Tim Haddad
Environmental Coordinator
I:cur:th:proj:BigLagoonNOPnotice2004CWPupd
4/27/04
No. 390 April 27, 2004

Exhibit 2: Final Environmental Impact Statement

Appendix B

Scoping Summary

Exhibit 2: Final Environmental Impact Statement

National Park Service
U.S. Department of the Interior

Golden Gate National Recreation Area
Division of Planning and Technical Services

Fort Mason, Building 201
San Francisco, CA 94123

415-561-4939 fax

BIG LAGOON WETLAND AND CREEK RESTORATION PROJECT
Scoping Summary
March 6, 2003

INTRODUCTION

The National Park Service (NPS) and the Golden Gate National Parks Conservancy are undertaking planning to develop alternatives for the Big Lagoon Wetland and Creek Restoration Project, located at the mouth of Redwood Creek in coastal Marin County. Conceptual design and environmental compliance for the project are funded jointly by the NPS Fee Demonstration Program, which is funded by visitor entrance fees to Muir Woods National Monument, and a California Coastal Salmon Recovery Fund grant from the California Department of Fish and Game.

This report summarizes the public and agency scoping phase for the project. Scoping, which is required under federal law for all projects requiring an Environmental Impact Statement (EIS), is an early and open process to determine the range of environmental issues and project alternatives to be analyzed in the EIS. Scoping for this project extended from October 2002 through January 16, 2003. This report describes:

- the project area;
- project goals;
- the scoping process and comments received through scoping; and
- next steps.

WHAT IS SCOPING?

The primary goal of scoping is to determine the range of issues and project alternatives to be addressed in planning and included in the environmental analysis for the project. During scoping, the park presents to the public a description of the project proposal and a list of project goals, and asks the public to submit comments, concerns, and suggestions related to the project.

Types of comments that are useful during scoping include:

- alternative approaches and ideas for accomplishing the project goals;
- environmental and socioeconomic issues that need to be addressed;
- other potential projects that might affect or be affected by this project;
- information that should be considered in the planning and analysis (such as related research or historical knowledge); and
- information on how the public uses the park and how the project might affect that use.

Scoping comments help define project opportunities and constraints and identify a range of project alternatives.

PROJECT AREA

The project site encompasses 40.9 acres at the mouth of Redwood Creek, which drains an 8.9-square-mile watershed on the southwestern flank of Mt. Tamalpais (Figure 1). Although the entire site is within the Golden Gate National Recreation Area (GGNRA) boundary, only half is owned by the NPS (Figure 1). The remainder is owned by the San Francisco Zen Center (SFZC) and is part of Green Gulch Farm. In addition, the project site is adjacent to the community of Muir Beach, an unincorporated residential community that is home to approximately 500 residents.

Historically, the project site supported a freshwater and brackish lagoon with associated permanent and seasonal wetlands, riparian woodland, and beach dune communities. Maps from the mid-nineteenth century depict a lagoon encompassing 12 acres of open water fringed by 13 acres of emergent wetland. Over the last century, much of the lagoon has been lost to increased rates of sedimentation that resulted from past agricultural land uses, manual filling of the lagoon to convert the wetlands to pasture for grazing, and construction of roads, levees, and the NPS parking lot in the historic lagoon. In addition, Redwood Creek has been channelized through much of the project area, and in portions of the project area the creek is confined between a levee and the NPS Muir Beach parking lot.

Recently, severe sedimentation has occurred in Redwood Creek channel within the project site. Recent surveys document more than five feet of sedimentation at one location since 1993. With the reduction in channel capacity resulting from this sedimentation, flooding on local roads near the creek has become severe.

The project site is also a popular visitor destination in the park, receiving approximately 440,000 visitors annually. Visitor uses at the site include picnicking, jogging, hiking, bicycling, horseback riding, wildlife watching, dog walking and others. Recent surveys indicate that the majority (65%) of visitors to the site are Bay Area residents and that the most common purpose for visiting the site is to "visit the beach/coast/ocean." Almost all visitors (94%) arrive at the site by personal vehicle, and approximately half (45%) of visitors remain at the site for only 1–2 hours. Visitor facilities at the site include a dirt/gravel parking lot with capacity for 175 cars, picnic tables, an interpretive kiosk, portable restrooms, a pay phone, and multi-use trails. Many of the trails reaching the site dead-end onto Pacific Way or Highway One, forcing visitors to travel on narrow shoulders along congested roadways to connect to other trails.

PROJECT GOALS

The goals of the Big Lagoon Wetland and Creek Restoration Project are to:

- Restore a functional, self-sustaining ecosystem, including wetland, aquatic and riparian components.
- Develop a restoration design that: (1) functions in the context of the watershed and other pertinent regional

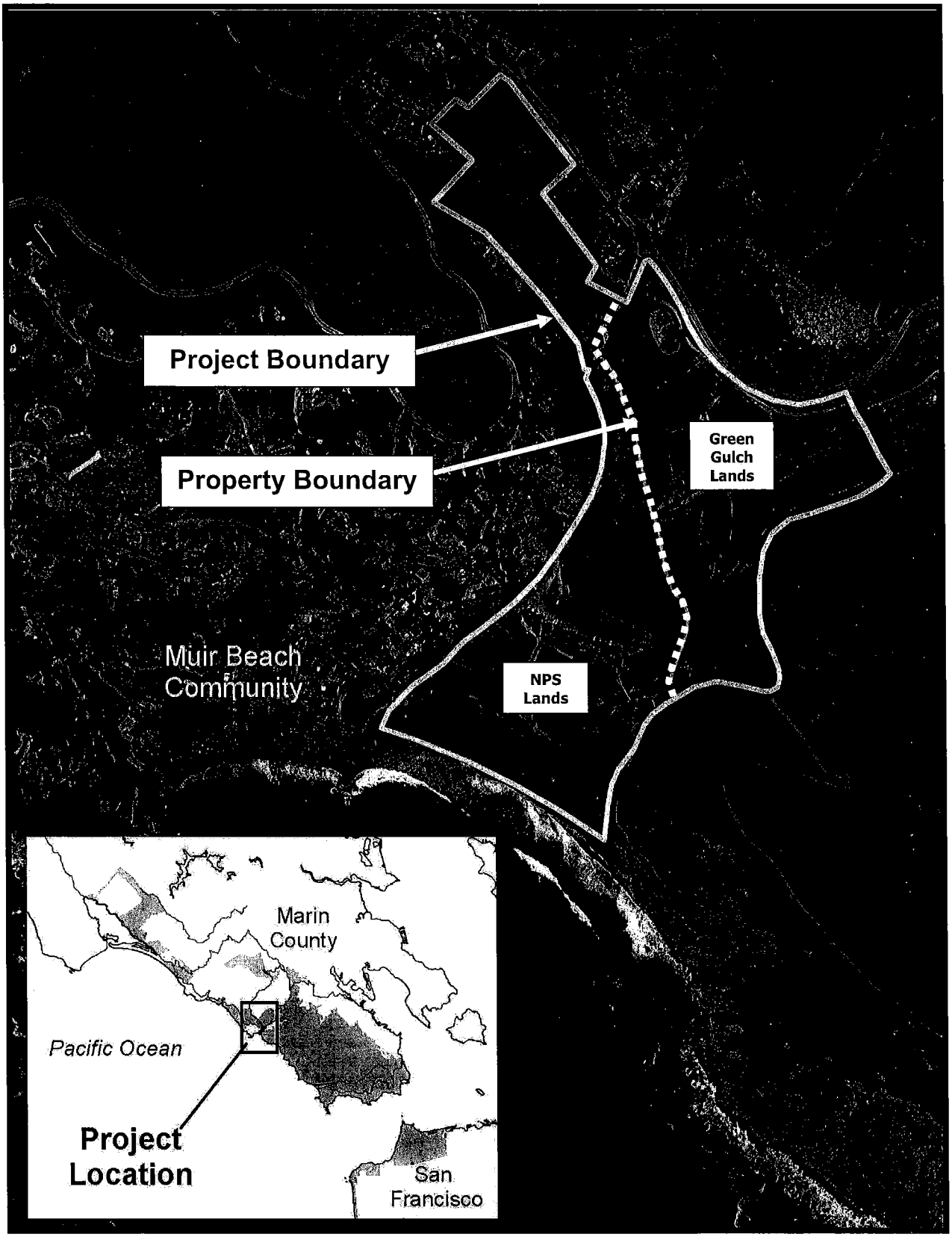

Figure 1. Big Lagoon Wetland and Creek Restoration Project Location and Project Boundaries

boundaries, and (2) identifies and, to the extent possible, mitigates factors that reduce the site's full restoration potential.

- Consistent with restoring a functional ecosystem, recreate habitat adequate to support sustainable populations of special status species. Reduce flooding on Pacific Way and in the Muir Beach community caused by human modifications to the ecosystem, and work with Marin County to ensure that vehicle access is provided to the Muir Beach community.
- Provide a visitor experience, public access, links to key locations, and resource interpretation that are compatible with ecosystem restoration and historic preservation.
- Work with the Federated Indians of Graton Rancheria to incorporate cultural values and indigenous archeological sites and resources into the restoration design, visitor experience and site stewardship.
- Provide opportunities for public education and community-based restoration, including engaging local and broader communities in restoration planning and site stewardship.
- Coordinate with the Comprehensive Transportation Management Plan to identify transportation alternatives that are consistent with ecosystem restoration.

PUBLIC INVOLVEMENT TO DATE

Public Scoping Meetings

Public scoping included public meetings and workshops, a field trip, and opportunities to submit written or electronic comments. The project was presented at a meeting of the GGNRA Advisory Commission on October 22, 2002, public workshops were held on October 29 and November 2, 2002, and a public field tour of the site was held on November 9, 2002. Notices of the meeting, workshops, and the field tour were sent to more than 570 individuals, organizations, and agencies. The meetings and field tour were further publicized through fliers posted at locations throughout Marin County, direct contact with 19 public organizations, and newspaper articles. A total of 34 people attended the public meetings, and eight attended the field tour.

Big Lagoon Working Group

Following the scoping meetings, a follow-up letter and Preliminary Scoping Update were distributed to more than 580 individuals, organizations, and agencies. This follow-up letter invited interested parties to participate in the kick-off meeting of the Big Lagoon Working Group, a group consisting of individuals, organizations, and public agencies convened to help develop restoration alternatives for the project. The kick-off meeting was held on December 5, 2002. Twenty-nine individuals participated in the meeting. The following agencies and organizations were represented:

- Alto Bowl Horse Owners Association
- California Department of Parks and Recreation
- California Native Plant Society
- Environmental Action Committee of West Marin
- Golden Gate National Parks Conservancy
- Marin Audubon Society
- Marin Conservation League
- Marin County Supervisors
- Miwok Valley Stables
- Mt. Tam Interpretive Association

- Muir Beach Community Services District
- Muir Woods Community Association
- National Park Service, Golden Gate National Recreation Area
- Ocean Riders
- San Francisco Regional Water Quality Control Board
- Sierra Club
- Tamalpais Conservation Club
- The Bay Institute

Agency Scoping

An additional meeting was held with public agencies on November 14, 2002. Agencies represented at the meeting included:

- California Coastal Commission;
- California Department of Fish and Game;
- Gulf of the Farallones National Marine Sanctuary;
- Marin County Community Development Agency;
- Marin County Department of Public Works;
- National Marine Fisheries Service;
- San Francisco Bay Regional Water Quality Control Board; and
- U.S. Army Corps of Engineers.

FREQUENTLY VOICED ISSUES/RECURRENT THEMES:

A wide range of opinions was voiced at the meetings and workshops and in subsequent comments received by mail and email. These comments are summarized below. A complete copy of comments received is available for review at the Planning Division Office located at the GGNRA Headquarters in Ft. Mason Building 201. For more information, please contact Jennifer Vick at (415) 561-4942 or Carolyn Shoulders at (415) 331-0771.

Natural Resources

- If feasible, the project should seek to restore the ecosystem that occurred at the site historically. This will require a detailed understanding of historic conditions and processes at the site.
- The project should create a healthy, functioning, self-sustaining ecosystem that will function in the long-term with minimal human intervention.
- Ecosystem function should be the primary goal of the project. Visitor access and parking should be secondary considerations at the site.
- The project should resolve conflicts between flooding in the local community and protection of natural resources.
- The project should remove hydraulic constraints to the creek and floodplain (such as the parking lot and the Pacific Way bridge), restore sediment transport capacity and continuity, and reduce sedimentation in the creek.
- Threatened and endangered species should be protected, and habitat conditions for salmon and steelhead should be improved.
- Open-water habitat for birds should be maximized.
- Fragmented habitats in the project area should be reconnected.
- More data need to be collected to assess impacts to birds of prey, tidewater goby, and monarch butterflies.
- The NPS should consider reintroducing California freshwater shrimp and tidewater goby after completion of restoration.
- Application of a Habitat Evaluation Procedure may be useful in analyzing trade-offs between restoration alternatives.

- Analysis of alternatives should consider the effects of upstream water diversions on the project.
- Sources of sediment from the upper watershed need to be considered in the project design.
- A limiting factors analysis should be completed for use in analyzing project impacts to salmonids.
- The alternatives analysis should describe resource trade-offs for each alternative being considered.

Cultural Resources Values

- Include Native American values and archaeological sites as components of the project.

Parking/Access

General Comment

- Cars and pedestrian traffic should be kept as separate as possible.
- Visitor traffic should be separated from the Muir Beach community and kept off Pacific Way.
- Access to the beach should be provided for elderly and disabled people as well as children who may not be able to walk long distances from a remote parking lot to the beach.
- Multiple options (parking lots, shuttles, trails, etc.) should be considered for providing access to the beach.
- The size of the parking lot could be reduced, and bicycle parking should be added.
- Depending on location, the parking lot could impact views from Highway One.

Parking Lot at the Current Location

- The current location and configuration of the parking lot causes flooding and harms the ecosystem.
- The current location of the parking lot requires large numbers of cars to drive on Pacific Way, causing conflicts with local traffic and emergency services.
- The current location of the parking lot is unsafe because traffic at the entrance to the lot is very congested.
- The parking lot causes dust and dirt for neighbors.
- A parking lot close to the beach provides good access for a range of beach users but may also draw more people and dogs than the site can support.
- The current parking lot location provides convenient beach access and minimizes impacts to views from Highway One.

Parking Lot Moved to Another Location on the Project Site

- A well-designed parking lot elsewhere on the project site could allow the Big Lagoon to flourish.
- Moving the parking lot closer to Highway One may cause dangerous traffic conditions on Highway One and increase congestion around Pelican Inn.
- Moving the parking lot closer to Highway One could impact views from Highway One.
- Moving the parking lot closer to Highway One would displace horses and the equestrian paddock and would have adverse economic effects on the Golden Gate Dairy stables. Impacts to equestrians should be considered for any parking lot alternative.
- A location at the downstream end of Green Gulch should be considered. This would allow public access to be provided along trails at the southern side of the site thus getting people off Pacific Way and onto a short, safe trail to the beach. The SFZC may be

sensitive to putting a parking lot on their lands at this location.

- The parking lot should not be moved to a location that would reduce forest cover and associated songbird habitat. Impacts to birds and other species (including red-legged frogs) should be considered for all parking lot locations.
- Moving the parking lot away from the beach could improve the visitor experience by providing a natural/wild trail experience along the route from the relocated parking lot to the beach.
- Moving the parking lot away from the beach may "de-intensify" visitor use.
- Moving the parking lot to another location on the project site would still leave parking lot impacts on the site and would prevent full restoration of the entire site.
- Hikers going from the center of Green Gulch Farm to the beach would enjoy a walk unobstructed by the parking lot.

Parking Lot Moved to a Location Further Upstream in Frank Valley

- Moving the parking lot out of the project site provides the greatest protection for natural resources at the site but also limits access to the site.
- Moving the parking lot out of the project site may reduce access to the beach for the elderly, disabled, and visitors with small children who may not be able to walk long distances from a remote parking lot.
- Since people rarely plan their trip to Muir Beach prior to the day of their visit, many visitors would not walk that far or use shuttles to get to the beach. Also there is currently no safe trail connection from a remote site to the beach.
- Moving the parking lot to the Ball Field site would adversely impact native birds (such as Virginia rails).
- If shuttles are used to transport people from a distant parking lot to the beach, the effects of the shuttles on traffic and air quality should be considered.
- If the parking lot is moved farther up Frank Valley, impacts to the Muir Beach water supply and potential increases in illegal parking along local roads should be addressed.
- Emergency services access should be considered in all alternative designs.
- Moving parking to a remote site may increase illegal parking along residential roads in the Muir Beach community.
- Moving the parking lot further up Frank Valley would bring more people to that area (which few people currently visit) thus detracting from visitor experience there.

Trails

- A system of environmentally sound and well maintained multi-use trails is needed to connect public lands, and consistent maps should be available from all land managers in the watershed.
- Good trail connections need to be provided between the Redwood Creek Trail and the Diaz Ridge Trail. The old "spinning trail" behind Pelican Inn or a new trail behind the houses on the east side of Highway One could be used to improve trail connectivity and safety.
- Local stewardship, such as an adopt-a-trail program or conservation alliance, would help foster community involvement and could improve trail conditions.
- Changes to trails that encourage bicycling could increase congestion on

trails or create user conflicts that discourage hikers and equestrians without reducing cars.
- Separate hiking and equestrian trails are desirable.
- Multi-use (i.e., hiking, biking, and equestrian) trails are desirable.
- A well defined trail to the beach is needed.
- The path from the Miwok Trail to Green Gulch Farm could be improved to provide access for hikers, mountain bikes, and road bikes to the beach.

Visitor Experience

- Muir Beach should maintain a wild, natural, and rural feel, not like Stinson Beach.
- Equestrians from many locations use the horse paddock near Pelican Inn.
- The NPS should determine the number of visitors that the site can support (i.e., visitor carrying capacity).
- Providing trail access through a natural area to get to the beach could improve visitor experience and would reduce conflicts on Pacific Way.
- Visitors should have safe access to the beach and safe trail connections.
- Interpretive nature trails and viewing areas should be added.
- A large visitor center and boardwalks should be avoided to maintain the rustic feel of the area.
- Restoring the ecosystem to a sustainable function may require reducing visitation at Muir Beach. This could be accomplished by reducing the size of and reconfiguring the parking lot, combined with electronic signs to direct people to other locations when the Muir Beach lot is full.

Public Participation/ Stewardship/Education

- A collaborative, public process should be used to develop project alternatives. This process could take the form of a "conservation alliance."
- Project information should be made available to the public at all stages of planning.
- Grassroots communication in the watershed should be encouraged.
- The NPS should work to get the public involved in stewardship of the site.
- The NPS should identify education opportunities provided by the project and should seek to provide education through the project. Education should include children.
- The NPS should start a school program for 6th, 7th, and 8th graders that involves students in monitoring, similar to the "lagoon watch" Duxbury Reef.
- Better communication is needed with the local community and beach users. Relying on the NPS liaison with the MBCSD to keep the community updated about the project is good, but more direct outreach to Muir Beach community residents is desired.
- If access to the beach is reduced, the NPS should implement an aggressive public education program to inform the public of the need to limit access for the benefit of natural resources.

Other Comments

- The existing equestrian use at the Golden Gate Dairy stables and at Green Gulch fields should be considered and accommodated in the project.
- Good science should provide the foundation for restoration planning.
- The project needs a formal mechanism for technical input and peer review. The NPS

should not rely solely on agencies as technical experts.
- Muir Beach residents need to be considered in the plan and should be mentioned in the project goals.
- Project funds should be spent wisely.
- NPS should provide a designated point of contact that is responsible for responding to and working on issues in the Muir Beach area.

PERMITS

Based on discussion at the agency scoping meeting, the following permits and documentation may be required for implementation of the project:

- Waste Discharge Requirement (Regional Water Quality Control Board);
- Stormwater Control Permit for on-going operations management of the project (Regional Water Quality Control Board);
- State and municipal NPDES permits for the construction and post-construction phase (Regional Water Quality Control Board);
- California Environmental Quality Act documentation;
- Consistency Determination (California Coastal Commission) [note that under the Coastal Act wetlands are defined by a one parameter method and recognize Environmentally Sensitive Habitat Areas, which encompass more than listed species habitat];
- Section 7 consultation pursuant to the Endangered Species Act (National Marine Fisheries Service and U.S. Fish and Wildlife Service);
- Section 10 Rivers and Harbors Act (U.S. Army Corps of Engineers); and
- Section 404 Clean Water Act (U.S. Army Corps of Engineers).

In addition, regulatory provisions may apply from the Marin Countywide General Plan, Muir Beach Community Plan, or the Marin County Local Coastal Plan.

NEXT STEPS

Over the next year, the NPS will draw upon these scoping comments, technical studies and surveys, and NPS guiding plans and policies to develop a range of restoration alternatives for the project site. Technical surveys and studies will be presented to the Big Lagoon Working Group, which will continue to meet monthly to help develop restoration alternatives. Dates, locations, and topics for Working Group meetings, as well as meeting notes will be posted on the project (www.nps.gov/goga/admin/planning).

Preliminary restoration alternatives will be presented to the public at a series of meetings and workshops in September 2003. Following this workshop, a draft Environmental Impact Statement will be completed and circulated for public and agency comment.

STAYING INVOLVED AND INFORMED

For more information about the project, please visit the project website at www.nps.gov/goga/admin/planning or call project co-managers Jennifer Vick at (415) 561-4942 or Carolyn Shoulders at (415) 331-0771.

To have your name added to or removed from the mailing list, please call (415) 561-4743 or email goga_muir_beach@nps.gov.

Exhibit 2: Final Environmental Impact Statement

Appendix C

Mitigation Monitoring and Reporting Plan

Exhibit 2: Final Environmental Impact Statement

Mitigation Monitoring and Reporting Plan

In compliance with the California Environmental Quality Act (CEQA), a lead agency must adopt a mitigation monitoring and reporting plan (MMRP) for the revisions the agency has required to a project and the measures it has proposed to avoid or mitigate significant environmental effects (CEQA Guidelines Section 15097). A Final Environmental Impact Statement/Environmental Impact Report (Final EIS/EIR) was prepared for the Golden Gate National Recreation Area (GGNRA) of the National Park Service's (NPS) and the County of Marin's (County's) Wetland and Creek Restoration at Big Lagoon, Muir Beach. The purpose of the MMRP is to ensure that the mitigation measures identified in the Final EIS/EIR are implemented and to identify who is responsible for their implementation.

Tables C-1, C-2, C-3 and C-4 of this MMRP, which follow this introductory section, identify the mitigation measures for the preferred alternative with respect to Restoration Alternative 2, Public Access Alternative B4, Bridge Alternative BR4, and the Unused Reservoir Pit Fill Disposal Alternative, respectively. These tables also identify the parties responsible for implementing and monitoring the mitigation measures, the timing of each mitigation measure, and a column for verification that the mitigation measure was properly implemented.

Exhibit 2: Final Environmental Impact Statement

Appendix C-1

Appendix C-1. Mitigation Monitoring and Reporting Program for Restoration Alternative 2

Impact	Mitigation	Implemented By	When Implemented	Monitored By	Verified By and Date
Restoration Alternative 2					
WQ-R1: Release of Construction-Related Sediment from Access Roads, Staging Areas, Ground-Disturbing Activities and Stockpiles	WQ-MM-1: Obtain Coverage under General Construction Permit and Implement BMPs	GGNRA or contractor	Prior to ground-disturbing activity	GGNRA	GGNRA
WQ-R2: Release of Construction-Related Hazardous Materials	WQ-MM-2: Implement Spill Prevention and Control Plan	GGNRA or contractor	Prior to and during construction	GGNRA	GGNRA
WQ-R3: Increased Turbidity in Redwood Creek Following Construction	WQ-MM-3: Implement Turbidity Monitoring and Response Plan	GGNRA or contractor	Prior to and during construction	GGNRA	GGNRA
WQ-R4: Increased Nutrients in Redwood Creek Following Construction	WQ-MM-4: Implement Water Quality Monitoring and Response Plan	GGNRA or contractor	Prior to and during construction	GGNRA	GGNRA
WQ-R5: Increased Water Temperatures in Redwood Creek Following Construction	WQ-MM-4	See referenced mitigation measure above			
AIR-R1: Generation of Construction-Related Pollutant Emissions	AIR-MM-1: Implement All Applicable BAAQMD Dust Control Measures	GGNRA or contractor	Prior to and during construction	GGNRA	GGNRA
	AIR-MM-2: Reduce NO_X Emissions from Off-Road Diesel-Powered Equipment	GGNRA or contractor	Prior to and during construction	GGNRA	GGNRA
WLD-R1: Effects of the Short-Term Loss of Mature Riparian Habitat on Riparian-Associated and Cavity-Nesting Avian Species	WLD-MM-1: Preconstruction Survey and Possible Installation of Nest Boxes	GGNRA or contractor	Prior to riparian tree removal	GGNRA	GGNRA
WLD-R3: Construction-Related Disturbance to Nesting Birds	WLD-MM-2: Conduct Preconstruction Bird Surveys	GGNRA or contractor	Prior to construction	GGNRA	GGNRA

Appendix C-1. Continued

Impact	Mitigation	Implemented By	When Implemented	Monitored By	Verified By and Date
WLD-R7: Construction-Related Mortality of California Red-Legged Frogs (CRLF)	WLD-MM-3: Limit Construction Access Routes and Equipment Staging Areas and Conduct Preconstruction Surveys for CRLF in All Suitable Habitat That Will Be Disturbed by Construction	GGNRA or contractor	Prior to and during construction	GGNRA	GGNRA
WLD-R8: Changes in Extent of CRLF Habitat	WLD-MM-4: Augment CRLF Breeding Habitat	GGNRA or contractor	Prior to construction	GGNRA	GGNRA
	WLD-MM-5: Implement Monitoring and Contingency Measures for CRLF	GGNRA	During construction and on an ongoing basis	GGNRA	GGNRA
	WLD-MM-6: Reintroduce CRLF to Supplement Existing Population On Site	GGNRA	Following construction	GGNRA	GGNRA
WLD-R12: Increased Salinity Levels and Effects on CRLF	WLD-MM-7: Implement Measures to Protect CRLF from Temporary Saltwater Intrusion.	GGNRA or contractor	During project design and construction	GGNRA	GGNRA
WLD-R13: Increased Predation on CRLF from Fish	WLD-MM-5	See referenced mitigation measure above			
WLD-R14: Overall Effects on CRLF	WLD-MM-5	See referenced mitigation measure above			
WLD-R15: Effects on Special-Status Bird Species	WLD-MM-1	See referenced mitigation measure above			
	WLD-MM-2	See referenced mitigation measure above			
WLD-R19: Effects on Bats	WLD-MM-8: Implement Measures to Protect Bat Populations	GGNRA	Prior to construction	GGNRA	GGNRA
FISH-R1: Increased Turbidity in Redwood Creek During Construction	Water Quality Mitigation Measures WQ-MM-1, WQ-MM-2, WQ-MM-3 and WQ-MM-4	See referenced mitigation measures above			
FISH-R2: Accidental Release of Construction-Related Hazardous Materials	Water Quality Mitigation Measure WQ-MM-2	See referenced mitigation measure above			

Appendix C-1. Continued

Impact	Mitigation	Implemented By	When Implemented	Monitored By	Verified By and Date
FISH-R3: Increased Water Temperatures in Redwood Creek Following Construction	FISH-MM-1: Riparian Shade Mitigation and Monitoring	GGNRA	During the 5 years following construction	GGNRA	GGNRA
FISH-R11: Effects on Juvenile Winter-Spring Salmonid-Rearing Habitat Immediately Following Construction	FISH-MM-2: Optimizing of Winter Rearing Habitat	GGNRA or contractor	During project design	GGNRA	GGNRA
FISH-R12: Effects on Juvenile Winter-Spring Salmonid-Rearing Habitat During Early Phases of Ecosystem Establishment	FISH-MM-2	See referenced mitigation measure above			
FISH-R13: Effects on Juvenile Winter Salmonid-Rearing Habitat During Later Phases of Ecosystem Establishment	FISH-MM-2	See referenced mitigation measure above			
CR-R1: Disturbance to Archaeological Site CA-MRN-333	CR-MM-1: Cultural Resources Education, Archaeological Monitoring, and Discovery Measures	GGNRA	Prior and during construction	GGNRA	GGNRA
CR-R2: Disturbance to the "Fan Site"	CR-MM-1	See referenced mitigation measure above			
	CR-MM-2: Educate the Workers Conducting the Harding Grass Removal and Have an Archaeological Monitor in the Vicinity of the Fan Site	GGNRA	Prior and during construction	GGNRA	GGNRA
CR-R3: Disturbance to CA-MRN-674	CR-MM-1	See referenced mitigation measure above			
CR-R5: Disturbance to Previously Unidentified Cultural Resources during Construction	CR-MM-1	See referenced mitigation measure above			
	CR-MM-2	See referenced mitigation measure above			
REC-R7: Short-Term Effects on Visitor Safety During Restoration Construction	REC-MM-1: Construction Exclusion Areas	GGNRA or contractor	During construction	GGNRA	GGNRA
	REC-MM-2: Horse and Equestrian Safety Measures	GGNRA or contractor	Prior to or during construction	GGNRA	GGNRA

Appendix C-1. Continued

Impact	Mitigation	Implemented By	When Implemented	Monitored By	Verified By and Date
TC-R1: Effects of Construction Mobilization and Materials Deliveries	TC-MM-1: Construction Traffic Management Plan	GGNRA or contractor	During construction	GGNRA	GGNRA
TC-R4: Effects of Truck Trips Associated with Fill Disposal	TC-MM-1	See referenced mitigation measure above			
PS-R2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner	PS-MM-1: Employ Sustainable Building Practices	GGNRA or contractor	During project design and construction	GGNRA	GGNRA
PS-R4: Increased demand for or conflict with utility lines or service systems	PS-MM-2: Maintain Utility Services	GGNRA or contractor	During construction	GGNRA	GGNRA
PS-R5: Increased Solid Waste Demands	PS-MM-1	See referenced mitigation measure above			
HS-R1: Risk of Accidental Explosion or Release of Hazardous Substances During Construction	WQ-MM-2	See referenced mitigation measure above			
HS-R4: Exposure of People to Undiscovered or Undocumented Sources of Contamination	HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/Remediation	GGNRA or contractor	During construction	GGNRA	GGNRA
NZ-R1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Construction Activities	NZ-MM-1: Employ Noise-Reducing Construction Practices	GGNRA or contractor	During construction	GGNRA	GGNRA
	NZ-MM-2: Prepare a Noise Control Plan	GGNRA or contractor	Prior to and during construction	GGNRA	GGNRA
	NZ-MM-3: Disseminate Essential Information to Residences and Implement a Complaint/Response Tracking Program	GGNRA or contractor	Prior to and during construction	GGNRA	GGNRA

Appendix C-2

Appendix C-2. Mitigation Monitoring and Reporting Program for Public Access Alternative B4

Impact	Mitigation	Implemented By	When Implemented	Monitored By	Verified By and Date
Public Access Alternative B4					
WQ-P1: Release of Construction-Related Sediment From Construction of Public Access Features	WQ-MM-1: Obtain Coverage Under General Construction Permit and Implement BMPs	GGNRA or contractor	Prior to ground-disturbing activity	GGNRA	GGNRA
WQ-P2: Release of Construction-Related Hazardous Materials	WQ-MM-2: Implement Spill Prevention and Control Plan	GGNRA or contractor	Prior to and during construction	GGNRA	GGNRA
AIR-P1: Generation of Construction-Related Pollutant Emissions	AIR-MM-1: Implement All Applicable BAAQMD Dust Control Measures.	GGNRA or contractor	Prior to and during construction	GGNRA	GGNRA
	AIR-MM-2: Reduce NO_X Emissions from Off-Road Diesel-Powered Equipment	GGNRA or contractor	Prior to and during construction	GGNRA	GGNRA
WLD-P1: Construction-Related Disturbance to Nesting Birds, Including Special Status Species	WLD-MM-2: Conduct Preconstruction Bird Surveys when necessary	GGNRA or contractor	Prior to construction	GGNRA	GGNRA
WLD-P2: Changes in Mature Riparian Habitat for Riparian-Associated And Cavity-Nesting Birds, Including Special Status Species	WLD-MM-1: Preconstruction Survey and Possible Installation of Nest Boxes	GGNRA or contractor	Prior to riparian tree removal	GGNRA	GGNRA
WLD-P4: Effects on Songbird Nesting Success Due to an Increase in Corvid Populations Facilitated by a Change in Public Access	WLD-MM-9: Implement Measures to Prevent Increases in Corvid Populations	GGNRA	Post construction	GGNRA	GGNRA
WLD-P5: Effects on Bats	WLD-MM-8: Implement Measures to Protect Bat Populations	GGNRA or contractor	Prior to construction	GGNRA	GGNRA

Appendix C-2. Continued

Impact	Mitigation	Implemented By	When Implemented	Monitored By	Verified By and Date
CR-P2: Disturbance to the "Fan Site"	CR-MM-1: Cultural Resources Education, Archaeological Monitoring, and Discovery Measures	GGNRA or contractor	Prior to and during construction	GGNRA or contractor	GGNRA or contractor
CR-P3: Disturbance to CA-MRN-675	CR-MM-1	See referenced mitigation measure above			
	CR-MM-3: Limit Compaction Methods Above the Recorded Deposit; Consult with NPS, the County, and FIGR; and Clarify Site Disposition During the Design Process.	GGNRA or contractor	Prior to and during construction	GGNRA or contractor	GGNRA or contractor
CR-P5: Disturbance to Previously Unidentified Cultural Resources During Construction	CR-MM-1	GGNRA or contractor	During construction	GGNRA	GGNRA
REC-P4: Short-Term Effects on Visitor Safety During Public Access Construction	REC-MM-1: Construction Exclusion Areas	GGNRA or contractor	During construction	GGNRA or contractor	GGNRA or contractor
	REC-MM-2: Horse and Equestrian Safety Measures				
TC-P1: Changes in Parking Availability During Construction	TC-MM-1: Construction Traffic Management Plan	GGNRA or contractor	During project design and construction	GGNRA	GGNRA
TC-P2: Effects of Construction Mobilization and Materials Deliveries	TC-MM-1	See referenced mitigation measure above			
TC-P5: Effects of Truck Trips Associated with Fill Disposal	TC-MM-1	See referenced mitigation measure above			
PS-P2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner	PS-MM-1: Employ Sustainable Building Practices	GGNRA or contractor	During project design and construction	GGNRA	GGNRA
PS-P4: Increased Solid Waste Demands	PS-MM-1	See referenced mitigation measure above			
HS-P1: Risk of Accidental Explosion or Release of Hazardous Substances During Construction	WQ-MM-2	See referenced mitigation measure above			

Appendix C-2. Continued

Impact	Mitigation	Implemented By	When Implemented	Monitored By	Verified By and Date
HS-P2: Exposure of People to Undiscovered or Undocumented Sources of Contamination	HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/Remediation	GGNRA or contractor	During construction	GGNRA	GGNRA
NZ-P1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Parking Lot Construction	NZ-MM-1: Employ Noise-Reducing Construction Practices	GGNRA or contractor	During construction	GGNRA	GGNRA
	NZ-MM-2: Prepare a Noise Control Plan	GGNRA or contractor	Prior to and during construction	GGNRA	GGNRA
	NZ-MM-3: Disseminate Essential Information to Residences and Implement a Complaint/Response Tracking Program	GGNRA or contractor	Prior to and during construction	GGNRA	GGNRA

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Appendix C-3. Mitigation Monitoring and Reporting Program for Bridge Alternative BR4

Impact	Mitigation	Implemented By	When Implemented	Monitored By	Verified By and Date
Bridge Alternative BR3					
WQ-B1: Release of Construction-Related Sediment from Construction of Bridge Alternatives	WQ-MM-1: Obtain Coverage Under General Construction Permit and Implement BMPs	County Department of Public Works Department of Public Works or contractor	Prior to ground-disturbing activity	County Department of Public Works Department of Public Works	County Department of Public Works Department of Public Works
WQ-B2: Release of Construction-Related Hazardous Materials	WQ-MM-2: Implement Spill Prevention and Control Plan	County Department of Public Works Department of Public Works or contractor	Prior to and during construction	County Department of Public Works Department of Public Works	County Department of Public Works Department of Public Works
AIR-B1: Generation of Construction-Related Pollutant Emissions	AIR-MM-1: Implement All Applicable BAAQMD Dust Control Measures	County Department of Public Works Department of Public Works or contractor	Prior to and during construction	County Department of Public Works Department of Public Works	County Department of Public Works Department of Public Works
	AIR-MM-2: Reduce NO_X Emissions from Off-Road Diesel-Powered Equipment	County Department of Public Works or contractor	Prior to and during construction	County Department of Public Works	County Department of Public Works
WLD-B1: Construction-Related Disturbance to Nesting Birds	WLD-MM-2: Conduct Preconstruction Bird Surveys, when necessary	County Department of Public Works or contractor	Prior to construction	County Department of Public Works	County Department of Public Works
WLD-B3: Effects on Bats	WLD-MM-8: Implement Measures to Protect Bat Populations	GGNRA, County Department of Public Works or contractor	Prior to construction	GGNRA, County Department of Public Works or contractor	GGNRA, County Department of Public Works or contractor
FISH-B2: Direct or Indirect Mortality and Increased Stress to Fish Due to Pile Driving and Increased Sound Pressure Levels	FISH-MM-3: Avoidance and Monitoring of High Sound Pressure Levels during Pile Driving Activities	County Department of Public Works or contractor	Prior to and during construction	County Department of Public Works	County Department of Public Works

Appendix C-3. Continued

Impact	Mitigation	Implemented By	When Implemented	Monitored By	Verified By and Date
CR-B1: Disturbance to CA-MRN-674	CR-MM-3: Limit Compaction Methods Above the Recorded Deposit; Consult with NPS, the County, and FIGR; and Clarify Site Disposition During the Design Process.	GGNRA, County Department of Public Works or contractor	During construction	GGNRA, County Department of Public Works or contractor	GGNRA, County Department of Public Works or contractor
CR-B2: Disturbance to Previously Unidentified Cultural Resources During Construction	CR-MM-1: Cultural Resources Education, Archaeological Monitoring, and Discovery Measures	GGNRA, County Department of Public Works or contractor	Prior to and during construction	GGNRA, County Department of Public Works	County Department of Public Works
TC-B1: Effects of Construction Mobilization and Materials Deliveries	TC-MM-1: Construction Traffic Management Plan	County Department of Public Works or contractor	Prior to and during construction	County Department of Public Works	County Department of Public Works
TC-B4: Effects of Truck Trips Associated with Fill Hauling	TC-MM-1	See referenced mitigation measure above			
TC-B5: Effects on Access and Safety on Pacific Way During Bridge Construction	TC-MM-1	See referenced mitigation measure above			
PS-B2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner	PS-MM-1: Employ Sustainable Construction Practices	County Department of Public Works or contractor	During project design and construction	County Department of Public Works	County Department of Public Works
PS-B5: Increased Demand for or Conflict with Utility Lines or Service Systems	PS-MM-2: Maintain Utility Services	County Department of Public Works or contractor	During construction	County Department of Public Works	County Department of Public Works
PS-B6: Increased Solid Waste Demands	PS-MM-1	See referenced mitigation measure above			
HS-B1: Risk of Accidental Explosion or Release of Hazardous Substances During Construction	WQ-MM-2	See referenced mitigation measure above			
HS-B2: Exposure of People to Undiscovered or Undocumented Sources of Contamination	HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/ Remediation	County Department of Public Works or contractor	During construction	County Department of Public Works	County Department of Public Works

Appendix C-3. Continued

Impact	Mitigation	Implemented By	When Implemented	Monitored By	Verified By and Date
NZ-B1: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Typical Construction Activities	NZ-MM-1: Employ Noise-Reducing Construction Practices	County Department of Public Works or contractor	During construction	County Department of Public Works	County Department of Public Works
	NZ-MM-2: Prepare a Noise Control Plan	County Department of Public Works or contractor	Prior to and during construction	County Department of Public Works	County Department of Public Works
	NZ-MM-3: Disseminate Essential Information to Residences and Implement a Complaint/Response Tracking Program	County Department of Public Works or contractor	Prior to and during construction	County Department of Public Works	County Department of Public Works
NZ-B2: Exposure of Noise-Sensitive Land Uses (Residents and Visitors) to Elevated Levels of Noise from Pile Driving	NZ-MM-1	See referenced mitigation measure above			
	NZ-MM-2	See referenced mitigation measure above			
	NZ-MM-3	See referenced mitigation measure above			

Exhibit 2: Final Environmental Impact Statement

Appendix C-4

Appendix C-4. Mitigation Monitoring and Reporting Program for Fill Disposal Alternative – Unused Reservoir Pit

Impact	Mitigation	Implemented By	When Implemented	Monitored By	Verified By and Date
Fill Disposal Alternative — Unused Reservoir Pit					
WQ-F1: Release of Construction-Related Sediment During Fill Disposal Activities	WQ-MM-1: Obtain Coverage Under General Construction Permit and Implement BMPs	GGNRA, County Department of Public Works, or contractor	Prior to ground-disturbing activity	GGNRA or County Department of Public Works	GGNRA or County Department of Public Works
WQ-F2: Release of Construction-Related Hazardous Materials During Fill Disposal Activities	WQ-MM-2: Implement Spill Prevention and Control Plan	GGNRA, County Department of Public Works, or contractor	Prior to and during fill disposal activities	GGNRA or County Department of Public Works	GGNRA or County Department of Public Works
AIR-F1: Generation of Construction-Related Pollutant Emissions	AIR-MM-1: Implement All Applicable BAAQMD Dust Control Measures.	GGNRA, County Department of Public Works, or contractor	During fill disposal activities	GGNRA or County Department of Public Works	GGNRA or County Department of Public Works
	AIR-MM-2: Reduce NO_X Emissions from Off-Road Diesel-Powered Equipment.	GGNRA, County Department of Public Works, or contractor	During fill disposal activities	GGNRA or County Department of Public Works	GGNRA or County Department of Public Works
	AIR-MM-3: Limit the Daily Number of Fill Disposal Trips	GGNRA, County Department of Public Works, or contractor	During fill disposal activities	GGNRA or County Department of Public Works	GGNRA or County Department of Public Works
VEG-F1: Construction-Related Impacts on Vegetation Communities	VEG-MM-1: Conduct Follow-Up Weed Control and Revegetation Activities to Establish Appropriate Native Plant Species	GGNRA, County Department of Public Works, or contractor	During construction	GGNRA, County Department of Public Works, or contractor	GGNRA, County Department of Public Works, or contractor
VEG-F2: Increase in Noxious Weed Populations	VEG-MM-1	See referenced mitigation measure above			
WLD-F1: Construction-Related Disturbances to Nesting Birds	WLD-MM-2: Conduct Preconstruction Bird Surveys when necessary	GGNRA, County Department of Public Works, or contractor	During construction	GGNRA, County Department of Public Works, or contractor	GGNRA, County Department of Public Works, or contractor

Appendix C-4. Continued

Impact	Mitigation	Implemented By	When Implemented	Monitored By	Verified By and Date
CR-F1: Disturbance to Previously Unidentified Cultural Resources During Construction	CR-MM-1: Cultural Resources Education, Archaeological Monitoring, and Discovery Measures	GGNRA, County Department of Public Works, or contractor	During fill disposal activities	GGNRA or County Department of Public Works	GGNRA or County Department of Public Works
CR-F3: Disturbance to the "Fan Site"	CR-MM-1	See referenced mitigation measure above			
	CR-MM-4: Fence Off the Fan Site Fill Hauling So That Trucks Cannot Inadvertently Damage the Site	GGNRA, County Department of Public Works, or contractor	During project design and construction	GGNRA, County Department of Public Works, or contractor	GGNRA, County Department of Public Works, or contractor
TC-F1: Effects of Fill Disposal Site Preparation	TC-MM-1: Construction Traffic Management Plan	GGNRA, County Department of Public Works, or contractor	During project design and construction	GGNRA or County Department of Public Works	GGNRA or County Department of Public Works
TC-F2: Effects of Truck Trips Associated with Fill Hauling	TC-MM-1	See referenced mitigation measure above			
PS-F2: Use of Non-Renewable Resources in a Wasteful or Inefficient Manner	PS-MM-1: Employ Sustainable Building Practices	GGNRA, County Department of Public Works, or contractor	During project design and construction	GGNRA or County Department of Public Works	GGNRA or County Department of Public Works
PS-F5: Increased Solid Waste Demands	PS-MM-1	See referenced mitigation measure above			
HS-F1: Risk of Accidental Explosion or Release of Hazardous Substances	WQ-MM-2	See referenced mitigation measure above			
HS-F2: Exposure of People to Undiscovered or Undocumented Sources of Contamination	HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/ Remediation	GGNRA, County Department of Public Works, or contractor	During fill disposal activities	GGNRA or County Department of Public Works	GGNRA or County Department of Public Works

Appendix D

Phillip Williams & Associates Bridge Analysis

Exhibit 2: Final Environmental Impact Statement

PWA
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FINAL M E M O R A N D U M

DATE: April 10, 2006

TO: Carolyn Shoulders

COMPANY: National Park Service

FROM: Ann Borgonovo, Matt Wickland

RE: **Bridge Sensitivity Analysis Using Hydraulic and Sediment Transport Modeling**
Big Lagoon Creek and Wetland Restoration

PWA Ref. #: 1664.03

Philip Williams and Associates (PWA) is pleased to present the results of the hydraulic and sediment transport analysis for various bridge configurations for the Big Lagoon Creek and Wetland Restoration project. This work has been performed under our scope of services with National Park Services (NPS) dated August 22, 2005. The purpose of this modeling is to provide further input on Marin County's Pacific Way Bridge design in support of the Environmental Impact Study/ Environmental Impact Report (EIS/EIR).

Hydraulic modeling results are presented first, including modeling approach, refinements and various iterations to meet design objectives. We then discuss the results of sediment transport analysis on select bridge designs. The supporting figures are listed at the end of this memorandum. The model cross-sections are also provided in Appendix A.

BACKGROUND

NPS is working toward restoring hydrologic and ecologic processes of Redwood Creek and Big Lagoon, near Muir Beach. All restoration alternatives included realigning Redwood Creek eastward to the valley low point and installing a new creek crossing along Pacific Way road. Currently the roadway is so low that it floods frequently during rain events, resulting in regular road closures. Although the current roadway does not function well for access, hydraulically it provides little obstruction to flood flows. Therefore replacing the bridge and raising the road to reduce road flooding has potential to increase upstream flood elevations in the vicinity of the Pelican Inn and homes on Lagoon Drive.

PWA has hydraulically evaluated alternative bridge designs to help alleviate this potential flooding. This analysis is an important step toward selecting the appropriate dimensions and design for the new bridge.

In addition, we have performed sediment transport analyses on selected bridge configurations to help characterize bridge effects on sediment transport.

HYDRAULIC MODELING APPROACH

The one-dimension hydrodynamic software MIKE 11 was used to model various different bridge scenarios for Redwood Creek under the 10-year and 100-year flow events. This modeling effort was a refinement of previous modeling performed as part of the Feasibility Study (PWA, 2002) and EIR/EIS analysis (PWA, 2005b). First we refined the Existing Conditions model which establishes baseline conditions and serves as the basis for comparing design options. We then modeled four basic scenarios for creek alignment and bridge location. For each scenario, we varied bridge dimensions (lengths and heights) to determine the minimum dimensions that would not increase 100-year water levels upstream of the bridge. The basic modeling scenarios are as follows:

Table 1 – Summary of Modeling Scenarios

Scenario	Description	Creek Alignment		Bridge Location
		Upstream of Bridge	Downstream of Bridge	
1	No Action (Alternative 1) Existing Conditions	Existing	Existing	Existing Location on Pacific Way
2	Creek Restoration (Alternative 2) No Bridge	New (1)	New (2)	Not Applicable (No Bridge)
3	Creek Restoration (Alternative 2) New Bridge	New	New	Centered at New Channel along Pacific Way
4	Creek Restoration (Alternative 2) Relocate Pacific Way & Bridge	New	New	Centered at New Channel ~80 ft south of Pacific Way
5	Modified Design Widen Existing Bridge	Existing	New	Existing Location on Pacific Way

(1) Realignment of the creek to the approximately low point of the valley, between the existing channel and Pelican Inn.

(2) Realignment of the creek to the approximate low point of the valley in Green Gulch pasture.

Scenarios 2 through 4 are variations of Alternative 2, the Creek Restoration. For reference, the conceptual design for the Alternative 2 (including refinements dated 5/18/05) is shown in plan and profile on Figures 1 and 44, respectively (PWA, 2005a).

Scenario 5 is a scaled-back version of the Creek Restoration which was requested by NPS. Under this modified design, the bridge and the upstream channel reach remain in the same general location. Downstream of the bridge the channel would be realigned to the approximate valley low point in Green Gulch pasture. Other assumptions for this scenario include:

- Dredging the existing channel upstream of the bridge (similar to New Channel dimensions below).
- Raising the road as needed to reduce flooding.
- Removal of the levee road and 90 feet of the parking lot (similar to Alternative 2).

The model setup for Scenario 1, Scenarios 2 through 4, and Scenario 5 are shown schematically on Figures 2, 3 and 4, respectively. The model cross-sections (A through S) are shown in Appendix A.

MODEL REFINEMENTS

PWA refined the hydraulic model to better reflect our current understanding of existing and design conditions during a large event (e.g. 100-year flood). We incorporated additional topographic data provided by NPS and refined some of our assumptions regarding roughness, bridge conditions and dimensions of the design channel. These refinements are discussed in more detail below.

Topographic Data

The MIKE-11 model was updated with new topographic survey data provided by NPS in August 2005. Two new cross-sections, C* and D*, were added to the model. (Note that Section C* was modified to reflect that the low area between the Pelican Inn and the fill pad north of the Pelican Inn is assumed to function as a backwater and would not significantly contribute to floodplain conveyance.) The longitudinal profile along the left bank of the existing channel (Figure 5) was also incorporated in the model to better characterize the link between the main channel and left floodplain.

The MIKE 11 model was originally constructed using topographic data from both ground surveys and aerial photogrammetry. In general, the channel sections are based on ground survey and the rest of the topography is from aerial photogrammetry (Towill, 2000). As a quality control check, surveyed cross-sections C* and D* were compared with aerial photogrammetry from approximately the same location. As shown on Figures 6 and 7, the aerial photogrammetry generally agrees with the ground survey, giving confidence in the accuracy of topographic data used in the model.

Channel and Floodplain Roughness

Floodplain and channel roughness values for the design conditions model were selected to simulate conditions after vegetation has established (greater than ~5 years). Therefore similar roughness values were used for existing and design conditions. In general, channel roughness was assumed to be 0.06 based on previous model calibration (PWA, 2005b). Floodplain roughness was assumed to vary with water depth. The selected roughness is 0.20 for flows up to 4 feet water deep. Above this water depth, the roughness was decreased to 0.12 to represent the lower resistance from floodplain vegetation.

Existing Channel

Under Existing Conditions, the dredged portion of the channel directly beneath and upstream of the Pacific Way Bridge was assumed to fill to pre-dredging elevations during a 100-year event. This

adjustment was made to reflect sediment deposition expected to occur upstream of the bridge during a large event. This assumption is based on the constriction of the existing bridge and is also consistent the sedimentation observed upstream of the bridge since 2002 dredging, as shown in Figure 8 (source: Environmental Data Solutions).

New Channel

For Design Conditions, the dimensions of the new channel were adjusted to better match field measurements of the existing channel upstream on the Banducci site. The design channel is five feet deep, with a bottom and top width of 25 and 35 feet respectively (Figure 44). These channel dimensions would result in some overbank flow during the 2-year event.

As another refinement, we assumed that a portion of the existing channel upstream of Pacific Way would remain (i.e. not be filled) to serve as a backwater channel. This will allow for some flood protection benefit, as well as provide some salmonid rearing habitat. This backwater channel is part of the previous design refinements for Alternative 2 (PWA, 2005a).

Another design approach for improving winter rearing habitat is to increase the frequency of out-of-bank flows downstream of the bridge by reducing channel conveyance. Currently the new channel has uniform dimensions throughout the project reach. However the channel has higher roughness and a slightly flatter slope in Green Gulch pasture, as compared to the reach upstream of the new bridge. The higher roughness value (n = 0.09) in Green Gulch pasture is based on our assumption that we would have more large woody debris (LWD) in the channel for complexity, habitat enhancement, etc. We assume less LWD will be placed and maintained in the upstream reach (n = 0.06) due to the proximity of private property and Pacific Way road. The channel slope upstream of the bridge (~3.7%) is more consistent with the channel profile upstream of the project boundary (roughly 4%); downstream of the bridge the channel slope flattens slightly (~2.5%) as it approaches the channel mouth. The channel has an approximate conveyance capacity of 560 and 300 cfs, upstream and downstream of the bridge, respectively. Therefore we anticipate that out-of-bank flows more frequently in the reach through Green Gulch pasture. As with all our modeling conditions, these assumptions will be refined during the detailed design phase.

New Bridge

For the model, the proposed bridge was assumed to have a two-foot thick deck and to be 36 feet wide, allowing for two-way traffic and a pedestrian path. The assumed bridge width was provided by Marin County; the actual bridge width may be reduced during detailed design. Bridges of 50 feet in length were modeled with no piers. We assumed that the bridges longer than 50 feet would have two-foot wide piers spaced at 40-foot intervals along the length of the bridge. (The bridge routine used in MIKE 11 is not sensitive to the exact locations or shape of bridge piers). Bridge submergence and overflow was allowed to occur in the model.

For Scenarios 3 and 4 the new bridge was assumed to be centered at the new channel. For Scenario 3 the bridge is located along the current road alignment. Under Scenario 4 we assumed that Pacific Way would be realigned perpendicular to the flow direction as shown on Figure 9. For Scenario 5 we assumed the existing bridge would be widened to the east.

Any bridge longer than 50 feet was modeled as three separate (but connected) bridge components spanning the right floodplain, channel and left floodplain. This approach better simulated how channel flows would be distributed across the floodplain during a 100-year event. This also allowed us to better represent the actual distance of the bridge from upstream structures, such as the Pelican Inn. Section D* on Figure 3 provides a graphic representation of how the bridge was modeled in MIKE-11.

The new bridge was modeled with the bridge openings approximately perpendicular to the flow direction. Where the bridge is aligned along Pacific Way, the actual bridge length may be slightly longer because the right floodplain opening is not perpendicular to Pacific Way. Therefore, for long spans under Scenarios 3 and 5, we estimated the bridge length (as measured along Pacific Way) assuming a skew angle of 30 degrees on the right floodplain. For shorter spans (150 feet or less) no adjustment was made for skew since flow would be mostly perpendicular to the bridge. Table 2 presents the modeled bridge opening and Table 3 presents the adjusted bridge length. For the road realignment under Scenario 4, the bridge would be perpendicular to the flow direction, so no bridge length adjustment was needed.

For channel and bank areas immediately underneath the bridge, a roughness value of 0.035 was used. For floodplain and overbank areas underneath longer-spanning bridges, the assumed roughness value was 0.045, assuming that the 36-foot wide bridge would shade-out most vegetation.

Pacific Way Road

In the hydraulic model, new Section D* was used to reflect the effects of Pacific Way Road (e.g. road height, roughness, etc.) under existing and design conditions. Each model scenario includes two to four closely spaced cross-sections (variations of Section D*) to represent the new or existing road. For some design scenarios we considered raising Pacific Way Road to reduce flooding. For this case, we assumed an embankment with approximately 3:1 (horizontal to vertical) side slopes. A roughness coefficient of 0.03 was used for Pacific Way road and the embankment.

HYDRAULIC MODELING RESULTS

Based on previous meetings with NPS and Marin County, we understand that at a minimum the new bridge cannot increase upstream flood elevations compared to Existing Conditions. Ideally the new bridge would provide additional benefits of reducing flooding levels for upstream properties. We used the model to test various bridge configurations (length, height and location) that meet this design criterion for the 100-year flow.

Table 2 provides a detailed list of model runs performed for this analysis. To allow comparison of flooding effects, we have presented the predicted water levels at the three structures closest to the bridge: the Pelican Inn, and the downstream and upstream homes on Lagoon Drive. The bridge configurations that achieve the design criteria of no increase at existing structures (to the nearest tenth of a foot) under the 100-year flood event are summarized in Table 3 below.

Table 3 – Bridge Configurations that Do Not Increase Flood Elevations under a 100-Year Event*

Scenario	Description	Bridge Dimensions		Raised Road Elevation (feet NGVD)
		Deck Elevation (feet NGVD)	Length (feet)	
3	Creek Restoration (Alternative 2) New Bridge at Pacific Way	21.5	266	~15 to 21.5
		18.0	300	~15 to 18
		16.5	50	15.5
4	Creek Restoration (Alternative 2) New Bridge 80 feet south of Pacific Way	21.5	200	~15 to 21.5
		17.0	280	~15 to 18
5	Modified Design (Widen Existing Bridge)	16.5	50	15.5

* Further analysis was performed to identify bridge configurations that also did not increase flood elevations under the 5-, 10- and 50-year events. See Tables 4 and 6 below.

For comparison we have also plotted predicted water levels profiles for Scenarios 1, 2, 3 and 5. For legibility we only plotted one bridge configuration for Scenario 3, the 50-foot bridge and raised road. Additional profiles for other bridge configurations, including Scenario 4, can be provided as needed.

The 10- and 100-year water levels for the right floodplain, near the Lagoon Drive structures, are shown on Figures 11 and 12, respectively. The 10- and 100-year water levels for the left floodplain close to the Pelican Inn are provided on Figures 13 and 14, respectively. The results for the various scenarios are discussed in more detail below.

Scenario 1 – Existing Conditions

Under Existing Conditions, Pacific Way road does not obstruct floodplain flows because it is essentially at grade between the existing bridge and Highway 1. Consequently the road floods frequently and is impassible for several days each winter.

Because the backwater effects for a new bridge would be most pronounced just upstream, the predicted water level at the Pelican Inn under Existing Conditions (17.1 feet NGVD) was established as the baseline for "no net change." Note that the finished floor of Pelican Inn (el. 17.65 feet NGVD) is approximately half a foot above the predicted 100-year water level for Existing Conditions.

Scenario 2 – Creek Restoration (No Bridge)
We first modeled the restored creek design without the bridge to understand changes to flood levels if there were no new obstructions on the floodplain. As shown in Table 2, this scenario decreased 100-year flood levels by approximately 0.4 feet at Pelican Inn and 0.7 feet further upstream on Lagoon Way.

Scenario 3 – Creek Restoration (New Bridge at Pacific Way)
We then modeled different configurations for a new bridge along Pacific Way that would not increase 100-year water levels at upstream structures. We developed three bridge configurations that met this criterion, which are shown schematically in Figures 9 and 10. Two configurations raise the roadway above the 100-year flood; the third raises the road but allows overtopping for flows above the 5-year event. The first configuration is a 266-foot span bridge with a deck elevation of 21.5 feet NGVD (approximately 10 feet above existing grade), and the second is a longer, 300-foot span with a lower deck at 18.0 feet NGVD.

We also evaluated other configurations that would allow some flooding of the road. We looked at the maximum elevation that we could raise the full length of the road without increasing 100-year flood levels at the Pelican Inn. Model sensitivity testing indicated that upstream water levels were more sensitive to a higher road than a shorter span bridge.

We found that the road raised to elevation 15.5 feet (based on the 5-year water level) and an approximately 50-foot long bridge (16.5-foot deck elevation) met the design criterion of not increasing flood elevations during a 100-year event. However, it should be noted that this configuration would raise water levels for the 10-year flow as shown on Figures 11 and 13. The 10-year water levels in the vicinity of the Pelican Inn would be raised approximately 0.5 to 1 foot. The higher 10-year water levels would be below the back steps and finished floor of the building.

The road would be overtopped during flows greater than the 5-year event. Predicted water depths above the raised road for the 10- and 100-year events are 3 and 12 inches, respectively (Table 7). This bridge configuration was tested further to see if the road could be raised higher. However, we found that raising the road to the 10-year water level would require a significantly longer span (similar to the first two configurations).

It should also be noted that culverts should be installed under the raised road to drain floodplain areas beyond the new channel berms and improve fish passage. A 3- to 5-foot diameter culvert could be installed on either side of the bridge. The culverts are expected to improve drainage during frequent storms, but could likely be blocked with flood debris during large (i.e. greater than 10-year) events.

Scenario 4 – Creek Restoration (Relocate Pacific Way)
Because the backwater effects of the bridge diminish with distance upstream, we looked at whether the bridge could be significantly smaller if it were located approximately 80 feet downstream (Figure 9).

Under this hypothetical scenario, the road would be located outside the County's right-of-way. As shown in Table 3, a bridge with a 21.5-foot deck elevation could be reduced in 200 feet, as compared to 266 feet under Scenario 3. A 280-foot bridge with a deck elevation of 17.0 feet NGVD (approximately 6 feet above existing grade) would also meet the design criterion.

Scenario 5 – Modified Design (Widen Existing Bridge)
We also modeled the Modified Design scenario which includes widening the existing bridge, dredging the upstream channel and realigning the downstream channel (Figure 4). For this scenario we assumed that the road would need to be raised to reduce the frequent road flooding. Except for the bridge location, this scenario is analogous to the raised road configuration for the full Creek Restoration (Scenario 3, Bridge 3), and produced similar results (see Figures 11 through 14).

Similar to Scenario 3, we found that a raised road at elevation 15.5 feet and a 50-foot long bridge (16.5-foot deck elevation) would meet the design criterion. This scenario also raises water levels in the vicinity of the Pelican Inn for the 10-year flow (Figures 11 and 13). The depth of road overtopping is slightly higher for this scenario than Scenario 3. In a 5-year event there would be approximately 2 inches water depth on the road; for 10- and 100-year flows the water depth would roughly one inch higher than under Scenario 3.

It should also be noted that installation of additional culvert(s) under the raised road would be even more important under this scenario because drainage will collect in the valley low point near the Pelican Inn. Because the culvert(s) drain a larger area, more frequent maintenance may be required than under Scenario 3.

COUNTY AND NPS MEETING (October 7, 2005)

The hydraulic modeling results summarized above were presented to representatives from NPS and Marin County in a stakeholder meeting on October 7, 2005. There was interest in further refining the bridge configuration with the 50-foot span and raised road (Scenario 3, Bridge 3). Although this scenario did not increase the 100-year water level, it increased the 10-year level by 0.5 to 1.0 foot compared to existing conditions.

NPS requested that PWA perform additional modeling to identify a bridge configuration that does not raise the water level for the 100-year as well as more frequent storm events. We varied the following parameters: bridge length (primary variable), bridge elevation and raised road elevation. We also modeled the following flow events: 5-, 10-, 50- and 100-year. The results are as follows:

Table 4 – Sensitivity Analysis Results for "Raised Road" Design

Description	Bridge Length	Bridge Deck Height	Road Height	Water Level on Floodplain Adjacent to Pelican Inn (feet NGVD)			
	(feet)	(feet)	(feet)	Q5	Q10	Q50	Q100
Existing Conditions	24	15.16(1)	~10-15	14.8	15.1	16.5	17.1
Creek Restoration (Alternative 2)							
Bridge 3	50	16.50	15.50	15.5	16.0	16.8	17.1
Test Run #18	150	16.50	15.50	14.6	15.7	16.8	17.2
Test Run #19	150	16.50	15.00	14.6	15.3	16.6	17.0
Bridge 4	150	16.25	14.50	14.7	15.1	16.4	17.0

(1) The maximum bridge elevation as reported in NPS's August 2005 survey results. Previous surveys show the soffit at an elevation of 12.59 ft.

Results for Existing Conditions and the 50-foot bridge (Bridge 3) are as presented above. Under this additional modeling effort, we first tried to widen the bridge to 100 feet, which still increased the 10-year water level. We then widened the bridge to 150 feet (run #18), which decreased the 5- and 10-year water level, but slightly increasing the 100-year level (Table 4). We think this 0.1-foot increase in the water surface is more due to a change in the model configuration, rather than the increased bridge length (described more below). Nonetheless, we proceeded with modifying the bridge configuration until predicted water levels for the four modeled events were less than existing conditions. Lengthening the bridge to 150 feet and lowering the bridge and road surface to elevation 16.25 and 14.5 feet NGVD, respectively, met this criterion. The plan and elevation views of this new bridge configuration (Bridge 4) are shown schematically on Figures 43 and 35, respectively.

Please note that the model configuration for the 150-foot bridge (Runs #18, 19 and Bridge 4) is different than that used for the 50-foot bridge (Bridge 3) because the bridge span is significantly wider than the 35-foot channel. To reflect both a bridge opening and raised road (effectively a weir) on the floodplain, we needed to revise how the channel and floodplain limits are defined in the model. It was not appropriate to apply this same modification to the Existing Conditions model, and therefore the results are not as comparable.

VALUE ANALYSIS WORKSHOP (January 19 - 20, 2006)

NPS and the County held a Value Analysis workshop on January 19 - 20, 2006 to help identify the preferred conceptual bridge design. The general consensus was that preferred bridge location is within the existing road right-of-way and spanning the realigned channel (Scenario 3). Therefore Scenarios 4 (outside the road right-of-way) and Scenario 5 (Modified Design) have not been modeled further.

Bridge with Minimal Road Raising (Bridge 5)

Following the workshop, NPS requested that we evaluate an additional bridge configuration that lowered the bridge deck and reduced the extent of raising the road. This additional configuration (Bridge 5) includes a 50-foot bridge span with a deck elevation of 15 feet NGVD. The road is raised only as needed to transition to the bridge deck (at 6% slope per the County). Bridge 5 is shown schematically in plan and profile on Figures 9 and 36, respectively.

Bridge 5 was modeled assuming the relocated creek location were approximately 150 feet from the Pelican Inn, similar to the other modeled bridge configurations. In addition, we qualitatively evaluated the advantages and disadvantages of locating the creek and bridge even closer to the Pelican Inn. The intent of moving the bridge would be to reduce the extent of fill needed to raise Pacific Way, thereby reducing new obstructions to floodplain flows. We developed schematic representations of this scenario to look at the consequences of moving the creek northward. Figures 37 (plan view) shows the channel moved to within 10 feet of the Pelican Inn parking lot; Figure 38 shows an elevation view at this creek location. (Please note that the configuration shown in Figures 37 and 38 was not modeled.)

It is useful to compare the Bridge 5 elevations shown on Figures 36 and 38 for the two different creek alignments. As shown on Figure 38, moving the bridge northward does not significantly reduce the amount of road fill required. However, the amount of floodplain obstruction would be somewhat reduced because some fill (approximately 7% of total embankment cross-sectional area) would be placed downstream of existing fill for the Pelican Inn. (The reduced floodplain obstruction is shown graphically in Figure 38 where the green and yellow lines overlap). Another limited advantage would be that since the bridge would be located closer to the valley low point, which could reduce the number and/or size of drainage culverts needed under the raise road (as discussed under Scenario 3 above). However, this creek location is undesirable from a fish habitat perspective. Locating the creek adjacent to the parking lot does not provide a sufficient riparian buffer, which would result in loss of shade and cover, increased human disturbances and potential water quality degradation from parking lot runoff.

Summary of Bridge Configurations

The basic bridge configurations considered during the Value Analysis were: a 50-foot span (with and without a raised road), a 150-foot span with raised road, and a maximum length bridge (266 to 300-foot span). These bridge configurations are summarized in Table 5 and shown in elevation on Figures 10, 35 and 36.

Table 5 – Summary of Bridge Configurations for Creek Restoration (Scenario 3)

Bridge Configuration	Deck Elevation (feet NGVD)	Length (feet)	Road Elevation (feet NGVD)	Increase Water Levels Upstream? (Table 6)	Predicted Road Flooding (See Table 7)	Geomorphic/ Ecological Function* (See Table 8)
1	21.5	266	~15 to 21.5	No	Rarely	●●●●●
2	18.0	300	~15 to 18	No	Rarely	●●●●●
3	16.5	50	15.5	Yes	Moderate	●●
4	16.25	150	14.5	No	Moderate	●●●●
5	15.0	50	~11 to 15	No	Frequent	●

* ●●●●● (5) is considered the highest relative rating for ecological/geomorphic function. See Table 8 below.

Predicted Water Levels

Table 6 shows predicted flood elevations near the Pelican Inn for the five bridge configurations. As shown in Table 6, Bridge 3 (50-foot span with raised road) will increase water levels at Pelican Inn (by less than one foot) for the 5-, 10- and 50-year events. All other bridge configurations either meet or reduce water levels compared to Existing Condition for the modeled flow events. (Note that Bridges 1 and 2 were not modeled for the more frequent flow events.)

Table 6 – Summary of Predicted Water Levels for Bridges 1 through 5

Description	Bridge Length	Bridge Deck Height	Road Height	Water Level near Pelican Inn[1] (feet NGVD)			
	(feet)	(feet)	(feet)	Q5	Q10	Q50	Q100
Existing Conditions	24	15.16 [2]	~10 to 15	14.8	15.1	16.5	17.1
Bridge 1	266	21.5	~15 to 21.5	N/A[3]	N/A	N/A	17.1
Bridge 2	300	18.0	~15 to 18	N/A	14.7	N/A	17.1
Bridge 3	50	16.5	15.5	15.5	16.0	16.8	17.1
Bridge 4	150	16.25	14.5	14.7	15.1	16.4	17.0
Bridge 5	50	15.0	~11 to 15	14.2	14.9	16.5	17.1

[1] Water level near the Pelican Inn structure. See Section D, Figure 4.

[2] The maximum bridge elevation as reported in NPS's August 2005 survey results. Previous surveys show the soffit at an elevation of 12.59 ft.

[3] N/A = modeling results not available.

We understand that bridge configurations 2, 4 and 5 were considered the preferred alternatives for further evaluation. To help compare flooding impacts, the 10- and 100-year water surface profiles for these three

configurations are shown on Figures 39 through 42. In general, the proposed bridge configurations lower the 10-year water level by roughly one-foot upstream of Pacific Way (Figures 39 and 40) compared to existing conditions. The predicted lowering of water levels is less pronounced during the 100-year flow conditions; water levels for proposed conditions are roughly 0 to 6 inches below existing conditions (Figures 41 and 42).

(Note that Bridge 2 appears to result in higher water levels near Pacific Way than Bridges 4 and 5, even though this bridge configuration creates less of a floodplain obstruction. This may be because the model configuration for Bridge 2 has fewer cross-sections near the bridge, therefore there are fewer data points for the profile. The additional cross sections were used for Bridges 4 and 5 to simulate the elevated road. Bridge 2 could not be modeled with additional cross sections since the bridge spanned nearly the entire floodplain and there is a minimum distance allowed between cross sections and bridges.)

Road Flooding

For configurations 1 and 2, the bridge would span the floodplain and be above the predicted 100-year water surface, so the bridge would rarely be overtopped. For configurations with shorter spans, the road would flood periodically. Table 7 shows the approximate duration of road inundation for Bridges 3 through 5 (as predicted by the MIKE-11 model). (Raising the road further would increase upstream flooding, and is therefore not acceptable.)

Table 7 - Average Water Depths for Bridges 3 to 5

Flow Event:	**5-Year**			**10-Year**			**100-Year**	
Bridge Configuration	**WSE[1] (feet NGVD)**	**Depth at Road[2] (inches)**	**Approx[4] Duration (hours)**	**WSE[1] (feet NGVD)**	**Depth at Road[2] (inches)**	**Approx[4] Duration (hours)**	**WSE[1] (feet NGVD)**	**Depth at Road[2] (inches)**
3) 50-ft bridge & raised road (el. 15.5 ft)	~15.5	N/A[3]	0	15.8	3	11.5	16.6	12
4) 150-ft bridge & raised road (el. 14.5 ft)	14.7	~3	5.5	~15.1	~5	11.5	~17	~30
5) 50-ft bridge & ramped road (el. 11-15 ft)	13.1	25	27	13.6	31	27	15.9	~60

(1) Average water surface elevation across the raised road. Water levels vary by up to 0.4 feet across the 50-foot wide road embankment.

(2) Maximum depth (in inches) at road, based on averaging the maximum water depths along the entire road profile.

(3) N/A = not applicable. No overtopping of the road.

(4) Approximate duration that any water would overtop the road, including periods of shallow flooding. The model cannot account for the conditions that may extend flooding duration such as tidal effects.

Of the five configurations, Bridge 5 results in the most frequent flooding because portions of the road will not be raised. Under this bridge configuration the road would flood (by roughly 12 inches) during the 2-year event (800 cfs). (However, predicted conditions in a 2-year flow are more approximate, since they are much more sensitive to the assumed channel dimensions, which are still preliminary.)

Ecological/Geomorphic Function

We have also provided a brief qualitative assessment of how the proposed bridge configurations would affect the geomorphic and ecological function of the channel and floodplain. As shown in Table 8 we rated each bridge configuration based on the following three characteristics:

1. Unsustainable Channel Migration – likelihood of channel avulsion outside of the bridge limits due to a) bridge blockage (by woody debris, accumulated sediment, etc.) and/or b) low resistance to channel headcutting (road that provides limited grade control function, by not having a raised embankment, non-erosive paving material, etc.).
   - ? Highest rating (5): Long/high bridge span.
   - ? Lowest rating (1): Short/low bridge span; at-grade road (low resistance to new channel formation).

2. Floodplain Connectivity – degree of a) longitudinal floodplain connectivity (provides wildlife corridor crossing Pacific Way) and b) channel-floodplain connectivity in the vicinity of the bridge.
   - ? Highest rating (5): Long bridge span.
   - ? Lowest rating (1): Short bridge span; raised road.

3. Natural Channel Function – degree to which a) channel adjustments (bank erosion and migration) are allowed without requiring armoring, and b) sediment deposition is allowed without requiring dredging or other channel maintenance (e.g. LWD removal).
   - ? Highest rating (5): Long bridge span.
   - ? Lowest rating (1): Short bridge span.

In general, a longer bridge spans (Bridges 1, 2 and 4) are rated highly for relative geomorphic and ecological function. The 50-foot bridge has low floodplain connectivity and channel function, with or without the raised road. However, raising the road should reduce the likelihood of the channel avulsing to either side of the bridge. For this reason, the 50-foot bridge with the raised road (Bridge 3) is considered to have higher geomorphic function than without the raised road (Bridge 5). The ratings in Table 8 are consolidated into one overall rating in Table 5 above.

Table 8 Basis for Brief Evaluation of Geomorphic/Ecological Function

Bridge Configuration	Deck Elevation (feet NGVD)	Length (feet)	Road Elevation (feet NGVD)	Channel Stability	Floodplain Connectivity	Natural Channel Function
1	21.5	266	~15 to 21.5	●●●●●	●●●●●	●●●●●
2	18.0	300	~15 to 18	●●●●●	●●●●●	●●●●●
3	16.5	50	15.5	●●●	●	●
4	16.25	150	14.5	●●●●	●●●●	●●●●●
5	15.0	50	~11 to 15	●	●	●

HYDRAULIC MODELING ACCURACY

The above results are appropriate for planning-level comparisons of design and existing conditions. Modeling assumptions are based on the current conceptual-level of creek restoration design. Future design refinements, such as actual bridge configuration, bridge width, road elevations, channel dimensions and channel slope, should be incorporated into the model as needed to confirm design criteria are met.

The accuracy of predicted water surface elevations are still limited because calibration data is only available for low flow conditions (i.e. limited overbank flow). Although we have refined our assumption regarding floodplain roughness, this estimate has not been calibrated.

Finally, the model was not initially set up for Scenario 5, the Modified Design, and has not been as refined as rigorously for this scenario. If this scenario is pursued further, we recommend that design assumptions and the model be further refined to reflect anticipated conditions.

SEDIMENT TRANSPORT MODELING

Sediment transport modeling was performed using MIKE-11 to (a) compare deposition patterns between existing and design conditions, (b) identify specific locations that are depositional and (c) help optimize the bridge configuration to minimize deposition.

In the October 7th, 2005 meeting, project stakeholders selected the following three cases in the for additional sediment transport modeling:

- Existing Conditions
- Creek Restoration and Bridge 3 (50-foot bridge and raised road)
- Creek Restoration and Bridge 4 (150-foot span bridge and raised road)

It should be noted that although not selected for sediment transport modeling, other bridge configurations may be considered further.

Modeling Approach

PWA first calibrated the sediment transport model for existing conditions using existing available field data, as described below. Following model calibration, both long-term and large event scenarios were modeled for existing conditions and the two proposed bridge configurations. Pre- and post-simulation bed level profiles were compared to identify the erosional and depositional reaches of the channel.

Following sediment transport modeling, we routed three flood events (e.g. the 5-, 10- and 100-year) for both pre- and post-simulation bed conditions and compared flood elevations. This evaluation of how sediment deposition would affect flood levels was performed for existing conditions and one design scenario.

Model Setup

PWA utilized the Engelund and Hansen sediment transport function available in MIKE 11 to model bedload (suspended load was determined to be insignificant). The Engelund and Hansen total load transport function is applicable to the range of substrate grain sizes found in Redwood Creek (Yang and Huang, 2001).

To focus efforts in modeling sediment transport and to provide model stability, only the main branch of Redwood Creek was allowed to experience erosion and deposition. The floodplains and linked branches could receive sediment from the main channel, but were not allowed to function as a sediment source to the main channel. This simplification is reasonable since most of the bedload would remain within the channel during an event less than 100 years in frequency.

Hydrology

Two different flow events were modeled as an attempt to capture the full range of potential transport scenarios. We simulated long-term bed level changes by modeling 5 years of "typical" flow data. Actual flows from December 2004 were used since this month contained the two-year event and another event with a peak about half that of the two-year flow. The hydrograph shown on Figure 15 was repeated five times to represent five years of "typical" flow.

We also modeled a larger single event that would provide more significant sediment loads and higher potential for bed erosion and deposition. The stream gage at Highway 1 provided data from an event on December 27, 2004, which was approximately a two-year event. This event lasted for two days and was followed by about eight days of higher than normal baseflows. The hydrograph from this 10-day event was roughly doubled, yielding a hydrograph representing approximately a 6-year occurrence interval (Figure 16).

Sediment Data

Sediment sampling data was obtained from Environmental Data Solutions and included several bedload discharge measurements and bed material grain size distributions (Stillwater, 2004). Based on the bedload measurements, a rating curve was developed to create sediment supply curves that accompanied each hydrograph used in the modeling. As a way to model different sediment sizes separately, the bedload was broken into four separate size classes, each with their own supply curves. The model used each of these four supply curves and accounted for each of these bedload classes independently.

Model Calibration

The existing conditions model was calibrated based on changes to the channel thalweg elevation (from 2004 and 2005 thalweg surveys) and measured flow data. We compared thalweg profiles taken from survey data in August 2004 and February 2005 (Figure 8). Major flow events between these periods were modeled and the calibration parameters were adjusted until a reasonable fit was found with the February 2005 profile. Because the 2004 survey had fewer data points than the 2005 survey, it was not possible to match the post-simulation thalweg exactly. However, for calibration purposes additional cross-sections were included in the model to better match the 2005 data points. See Figure 17 for the calibration results.

Boundary Effects

Sediment transport modeling results at the upstream and downstream ends appear to be artificially influenced by model boundary conditions and should be disregarded.

For all simulations, the model consistently predicts erosion at the upstream model boundary (between Stations 3000 and 3500). We used the 50-foot bridge model to test whether the predicted erosion was due to model instability at the upstream boundary. We extended the boundary 650 feet upstream and reran the model. Figures 24 and 26 show results for the same model with the standard and extended upstream boundary condition, respectively. As shown in these figures, extending the boundary condition reduced the maximum erosion depth from approximately 1.5 to 0.5 feet, indicating that this erosion, or at least the predicted magnitude, is likely a modeling artifact.

For the hydraulic modeling scenarios, the downstream boundary is typically mean higher high water (MHHW) to represent tidal conditions. However, for sediment transport modeling, use of a high tide caused backflow during periods of low flow (between storms events in the long-term simulation). To stabilize the model the starting water surface was lowered to elevation 0.0 feet NGVD, which tended to overstate downstream erosion. For this reason the results at the downstream end of the model (roughly Station 0 to 500) are not considered valid.

SEDIMENT TRANSPORT RESULTS

The sediment transport modeling results for five years of "typical" flow are presented on Figures 18, 19 and 20. These plots compare the pre- and post-simulation channel profiles for the three cases modeled.

The difference in thalweg elevation from pre- and post-simulations can be used to infer general patterns of deposition and erosion. Figure 21 compares the change in thalweg elevation for existing and design conditions (50- and 150-foot bridge).

The modeling indicates that under existing conditions, the channel bed is expected to generally be more erosional than depositonal in the long-term (Figure 18). However, this prediction does not correlate well with the significant sediment accumulation observed since the early 1990s, as shown on Figure 22 (PWA, 2003). Redwood Creek experienced roughly 1 to 4 feet of channel deposition downstream of Pacific Way between 1992/3 and 2002 (prior to dredging by NPS).

Because the "five-years of flow" model simulation did not correspond well with observed results, we also modeled a single event to see if reasonable long-term sediment predictions were beyond the capabilities of the model. We modeled an event with roughly a 6-year return period (Figure 16). The sediment transport modeling results for the single 6-year event are presented on Figures 23, 24 and 25. A comparison of bed change for the three cases modeled is provided on Figure 27. These simulation results correlated better with design expectations that the restored channel would have higher sediment transport capacity resulting in a more stable channel bed.

Sediment transport results for the three models are discussed below, followed by some general conclusions.

Existing Conditions

For Existing Conditions (Alternative 1 – No Action) the modeling results for the long-term and single event simulations are shown on Figures 18 and 23, respectively. Under existing conditions the most notable bed changes are around the existing bridge. For the single event, there is a zone of significant deposition a few hundred feet upstream of the bridge, while in the long-term the zone of accumulated sediment extends approximately 100 feet downstream of the bridge. In both cases, erosion is predicted just downstream of deposited sediment (presumably due to the "hungry water" effect). The exact location of the deposition appears to be affected by the duration of the simulation; the longer the simulation, the more the zone of deposition extends downstream.

Creek Restoration (50-foot span Bridge)

For design conditions (Alternative 2 – Creek Restoration) we performed sediment transport modeling for the 50-foot span bridge (soffet el. 14.5 feet) with the road raised to el. 15.5 feet (Bridge 3). The long-term and single event modeling results for the 50-foot span bridge are shown on Figures 19 and 24, respectively. For the single event (Figure 24), the model predicts that the "design channel" will be relatively stable, with no areas of significant deposition or erosion. For the long-term simulation (Figure 19), more extreme patterns of deposition or erosion emerge, as discussed below.

The model predicts that the channel bed under the creek restoration will be slightly depositional upstream of the bridge and erosional just downstream. The limited erosion (2 inches) predicted just downstream of the bridge (Station 2500) in the single event (Figure 24) appears to be significantly magnified (3.5 feet) in the long-term simulation (Figure 19). The cause for the predicted erosion, and therefore its likelihood, is not clear based on our analysis of maximum velocity, shear stress and flow width for this single event (shown on Figures 28, 29 and 30, respectively). This large scour prediction may be influenced by how the bridge is modeled. (The modeled channel "limits" [different than channel dimensions] are normally 35 feet wide, but expand to 50 feet at the bridge to capture its full span. The predicted scour may be partly caused by the contraction of the channel limits back to 35 feet just downstream of the bridge.)

The model also predicts channel bed deposition in the reach through Green Gulch pasture. This deposition may be due to decreased channel conveyance through this reach as discussed above under Model Refinements.

Creek Restoration (150-foot span Bridge)

We also performed sediment transport modeling for the same design conditions but with the 150-foot span bridge (soffet el. 14.25 feet) and road raised to el. 14.5 feet (Bridge 4). The long-term and single event modeling results for the 150-foot span bridge are shown on Figures 20 and 25, respectively. As shown on Figures 21 and 27, the predicted bed changes for design conditions with the 150-foot bridge and similar to those for the 50-foot bridge, except just downstream of the bridge. For the long-term simulation, both deposition and less severe erosion are predicted for the 150-foot bridge, compared to the high erosion predicted for the 50-foot bridge. Again, the exact cause of this erosion, and therefore whether conditions would actually be improved with a longer bridge, is unknown. (However, it should be noted that the 150-foot bridge was modeled with consistent channel limits, unlike the 50-foot bridge. This provides some indication that the predicted scour for the 50-foot bridge is indeed a modeling artifact.)

Predicted Water Levels

Following sediment transport simulations, we also routed flood flows through the model for pre- and post-simulation bed conditions. We then compared the results to determine how much effect predicted "long-term" changes (i.e. five years) to the channel bed would affect flood levels near existing structures. Figures 31 and 32 show comparative 5-year flood levels for existing conditions and design conditions (150-foot bridge), respectively. Figures 33 and 34 show 100-year flood levels for existing conditions and design conditions, respectively. As shown on Figure 32, for the design conditions the predicted deposition upstream of the bridge would increase the 5-year water surface by approximately 2 to 4 inches. The change in water level is much less pronounced for the 100-year flow (Figure 34); however, the model predicts an approximately 4-inch increase in water surface just upstream of the Pelican Inn.

Conclusions

Our general conclusions regarding sediment transport modeling results are as follows:

- The single event modeling results appear to be less susceptible to distortion by the transport model, and therefore more reliable than the long-term simulation for drawing general conclusions.

- The sediment modeling results should be considered general predictions of depositional and erosional patterns, rather than qualitative predictions of changes to thalweg elevations.

- Although the existing conditions model was calibrated using actual field measurements, the long-term model predictions are not consistent with actual long-term observations. Potential factors may be because the model calibration data was only available for a limited channel reach (roughly 200 feet), and because the model does not adequately capture tidal influences.

- The existing conditions model predicts a zone of significant sediment deposition in the vicinity of the Pacific Way Bridge. The location of the deposition, including whether it is upstream or downstream of the bridge, varied for different simulations.

- In general, based on results for a single event, the channel under design conditions appears to be more stable than the existing channel, having no areas of significant deposition or erosion.

- For design conditions, the model predicts that there will be some sediment deposition upstream of the bridge. The sediment deposition is predicted to be distributed relatively evenly throughout the upstream reach.

- The sediment transport model does not predict any significant difference in erosion and deposition trends between the 50- and 150-foot bridges, except within 200 to 600 feet downstream of the new bridge. The model predicts that the 150-foot bridge would cause less erosion than the 50-foot bridge within 200 to 600 feet downstream of the new bridge; however results for this area may be skewed by a modeling artifact.

- Sediment deposition upstream of the new bridge will have some effects on flood levels; however the modeling is not accurate enough to predict how quickly sediment will accumulate.

Channel Maintenance

In addition to sediment transport modeling results, the following general points regarding future channel maintenance can be made based on our understanding of the geomorphic function of Redwood Creek. The creek restoration design is expected to reduce channel deposition, and therefore the frequency of channel dredging, for the following reasons:

- The new channel will be graded with a more uniform gradient and configuration (i.e. cross-sectional dimensions) which should increase sediment transport capacity.

- The new channel will be located closer to the valley low point, which will help keep flows concentrated in the channel, thus increasing sediment transport capacity, and sustaining the channel gradient and configuration. (Currently flow leave the channel upstream of the bridge, and do not return to the main channel until downstream of Green Gulch pasture).

- The existing bridge with be replaced with a larger span bridge, oriented parallel to the flow direction, which will reduce backwater effects that cause sediment deposition.

The sediment transport modeling did not conclusively show to what degree a significantly longer bridge (e.g. 150-foot versus 50-foot span) would reduce sediment deposition. However, in general, increasing the bridge span (and deck height) increases upstream flood protection. Therefore, even if a larger bridge does not significantly impact sediment transport, it could still reduce the required frequency of maintenance dredging for flood protection. A larger bridge is also less susceptible to debris blockage, reducing the need for other channel maintenance activities, such as LWD removal.

LIST OF FIGURES

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43	Schematic Plan for 150' Span Bridge
44	Conceptual Cross-section: Alternative 2 Creek Restoration

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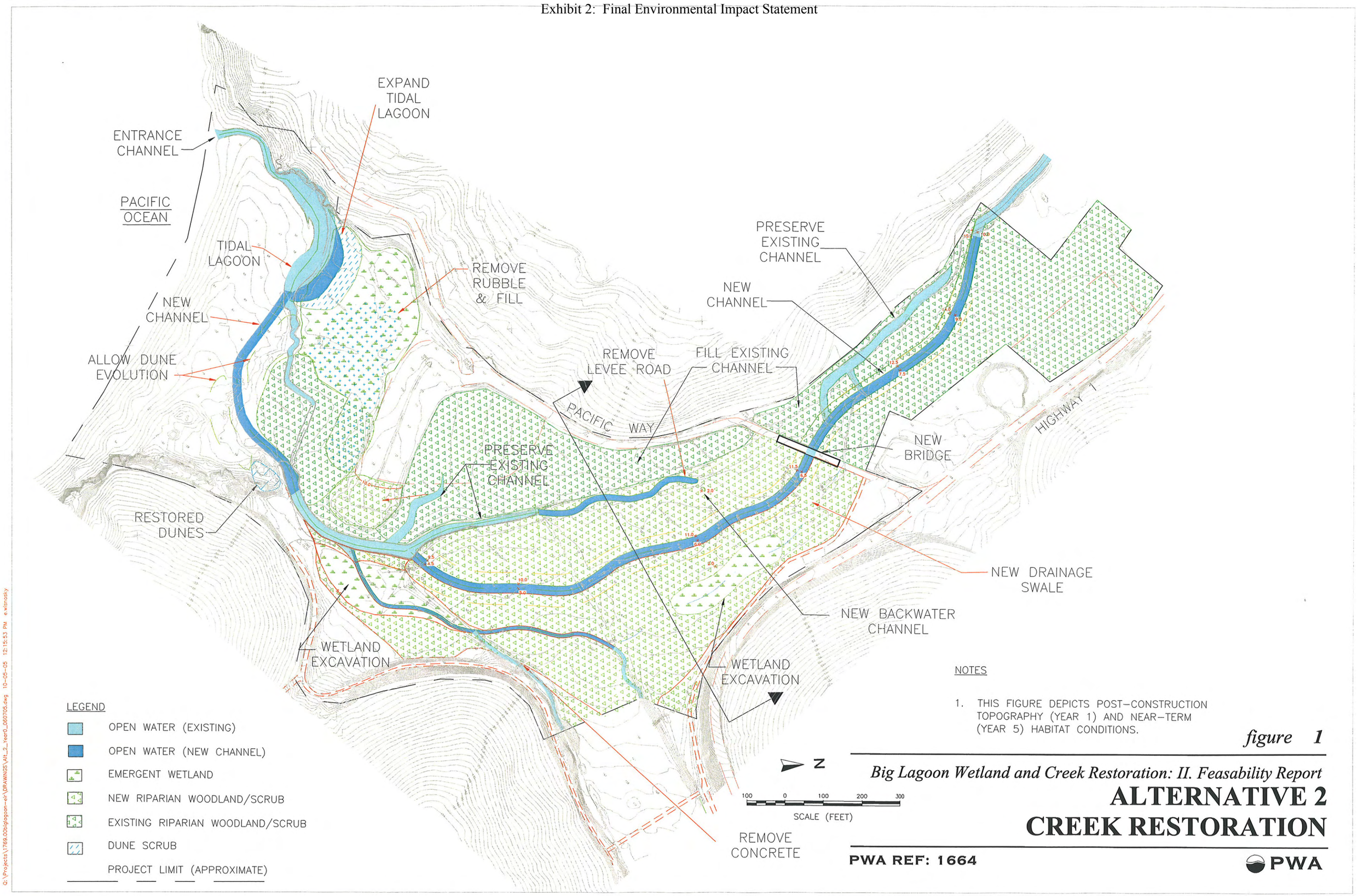
Table 2
Details of Model Runs for Bridge Analysis
Big Lagoon Wetland and Creek Restoration
PWA #1664.03

				Independent Variables										Dependent Variables				
Run Number	Description			Bridge Dimensions						Bridge Modeling Method		Other Conditions		100-Year Flood Elevations (feet NGVD)			Other	
		Scenario	Alternative	Opening Width (ft)	Soffit Elevation (NGVD)	Deck Elevation (NGVD)	Downstream Location	Lateral Location	Skewness	Normal Channel	Segmented (including floodplains)	New Cross Sections (C* & D*)	Leave Existing Channel (C-E)	Pelican Inn (17.65 NGVD)	D/S Home Lagoon Dr. (15.0 NGVD)	U/S Home Lagoon Dr. (14.7 NGVD)	Accessibility of Road	Dredging Required
10	Existing Conditions (No Action)	1	Alt 1	24	12.6	15.0	At Road	Current Bridge	0%	X		X***		**17.11**	17.60	18.39	~1.5 yr event	Yearly
11	Creek Restoration- No Bridge	2	Alt 2	No Bridge	-	-	-	-	-	X		X***	X	**16.69**	17.06	17.67	No Bridge	None
12	Creek Restoration- New Bridge	3	Alt 2	**250**	19.5	21.5	At Road	Center of FP	0%		X	X***	X	**17.12**	17.42	17.91	100 yr event	N.A.
13	Creek Restoration- New Bridge	3	Alt 2	280	**16.0**	18.0	At Road	Center of FP	0%		X	X***	X	**17.11**	17.41	17.91	100 yr event	N.A.
16	Creek Restoration- New Bridge & Raised Road	3	Alt 2	**50**	14.5	16.5	At Road	Center of FP	0%	X		X***	X	**17.12**	17.45	17.98	5 yr event	
14	Creek Restoration- New Bridge Downstream	4	Alt 2	**200**	19.5	21.5	~200' DS	Center of FP	0%		X	X***	X	**17.15**	17.45	17.95	100 yr event	N.A.
15	Creek Restoration- New Bridge Downstream	4	Alt 2	280	**15.0**	17.0	~200' DS	Center of FP	0%		X	X***	X	**17.04**	17.36	17.89	100 yr event	N.A.
17	Modified Design - Widen Bridge & Raised Road	5	N/A	**50**	14.5	16.5	At Road	Current Bridge	0%	X		X***		**17.08**	17.47	18.11	5 yr event	

Exhibit 2: Final Environmental Impact Statement


EXPAND TIDAL LAGOON
ENTRANCE CHANNEL
PACIFIC OCEAN
TIDAL LAGOON
REMOVE RUBBLE & FILL
NEW CHANNEL
ALLOW DUNE EVOLUTION
PRESERVE EXISTING CHANNEL
NEW CHANNEL
REMOVE LEVEE ROAD
FILL EXISTING CHANNEL
PACIFIC WAY
HIGHWAY 1
NEW BRIDGE
PRESERVE EXISTING CHANNEL
RESTORED DUNES
NEW DRAINAGE SWALE
NEW BACKWATER CHANNEL
WETLAND EXCAVATION
WETLAND EXCAVATION
REMOVE CONCRETE
N
100 0 100 200 300
SCALE (FEET)
LEGEND
OPEN WATER (EXISTING)
OPEN WATER (NEW CHANNEL)
EMERGENT WETLAND
NEW RIPARIAN WOODLAND/SCRUB
EXISTING RIPARIAN WOODLAND/SCRUB
DUNE SCRUB
PROJECT LIMIT (APPROXIMATE)
NOTES
1. THIS FIGURE DEPICTS POST-CONSTRUCTION TOPOGRAPHY (YEAR 1) AND NEAR-TERM (YEAR 5) HABITAT CONDITIONS.
figure 1
Big Lagoon Wetland and Creek Restoration: II. Feasability Report
ALTERNATIVE 2
CREEK RESTORATION
PWA REF: 1664
PWA

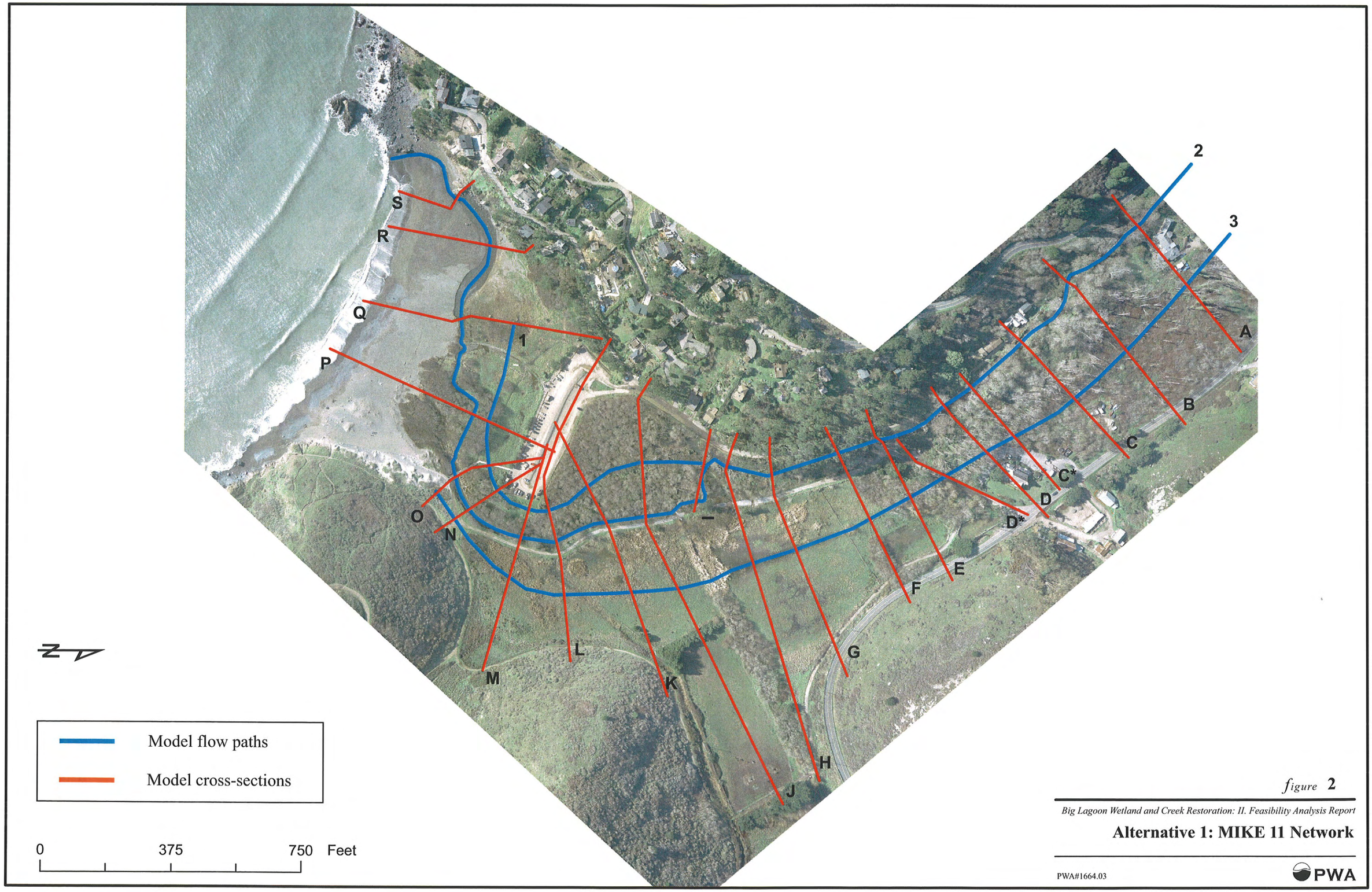


figure **2**

Big Lagoon Wetland and Creek Restoration: II. Feasibility Analysis Report

Alternative 1: MIKE 11 Network

PWA#1664.03

PWA

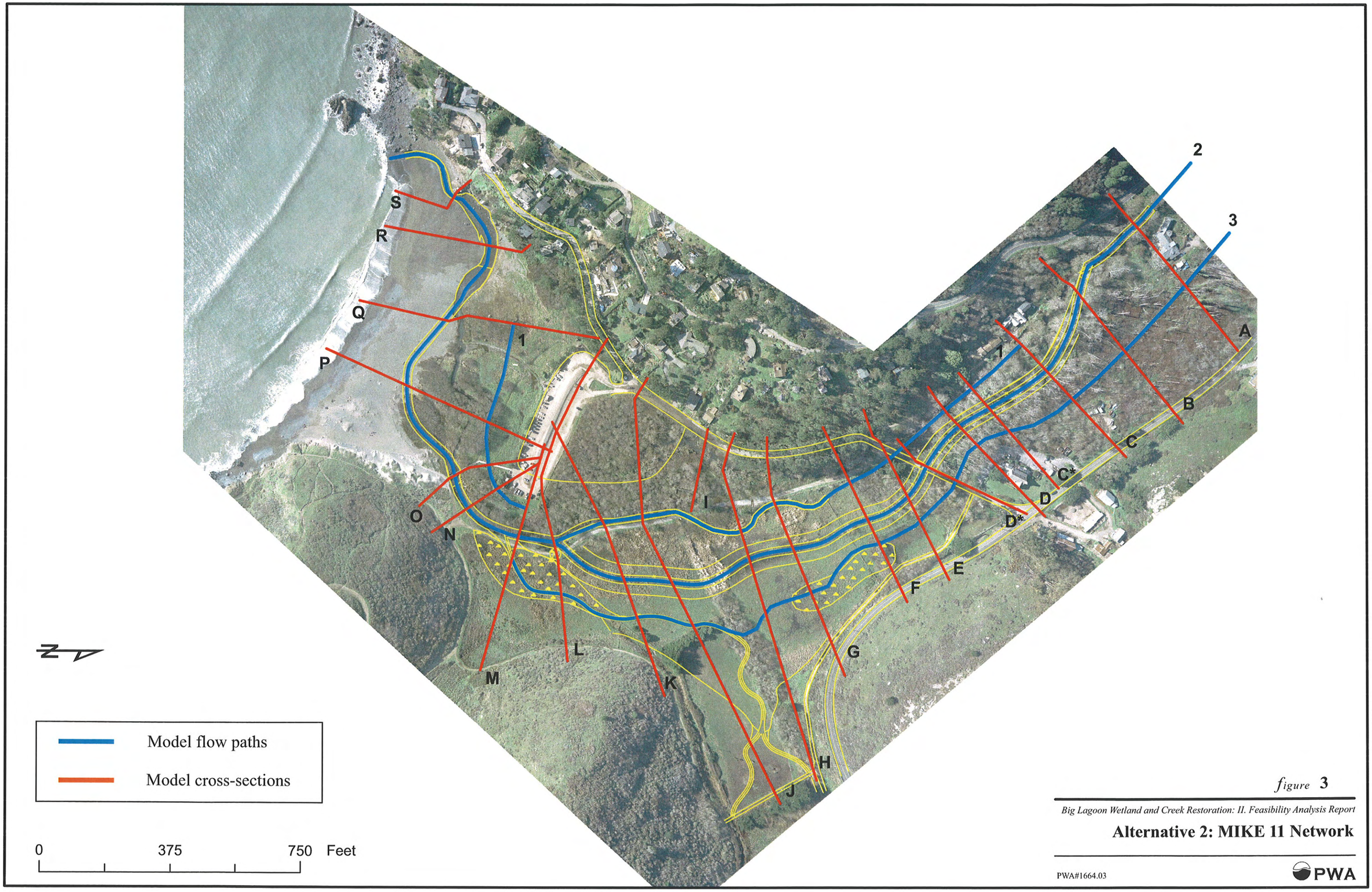


figure **3**

Big Lagoon Wetland and Creek Restoration: II. Feasibility Analysis Report

Alternative 2: MIKE 11 Network

PWA#1664.03

PWA

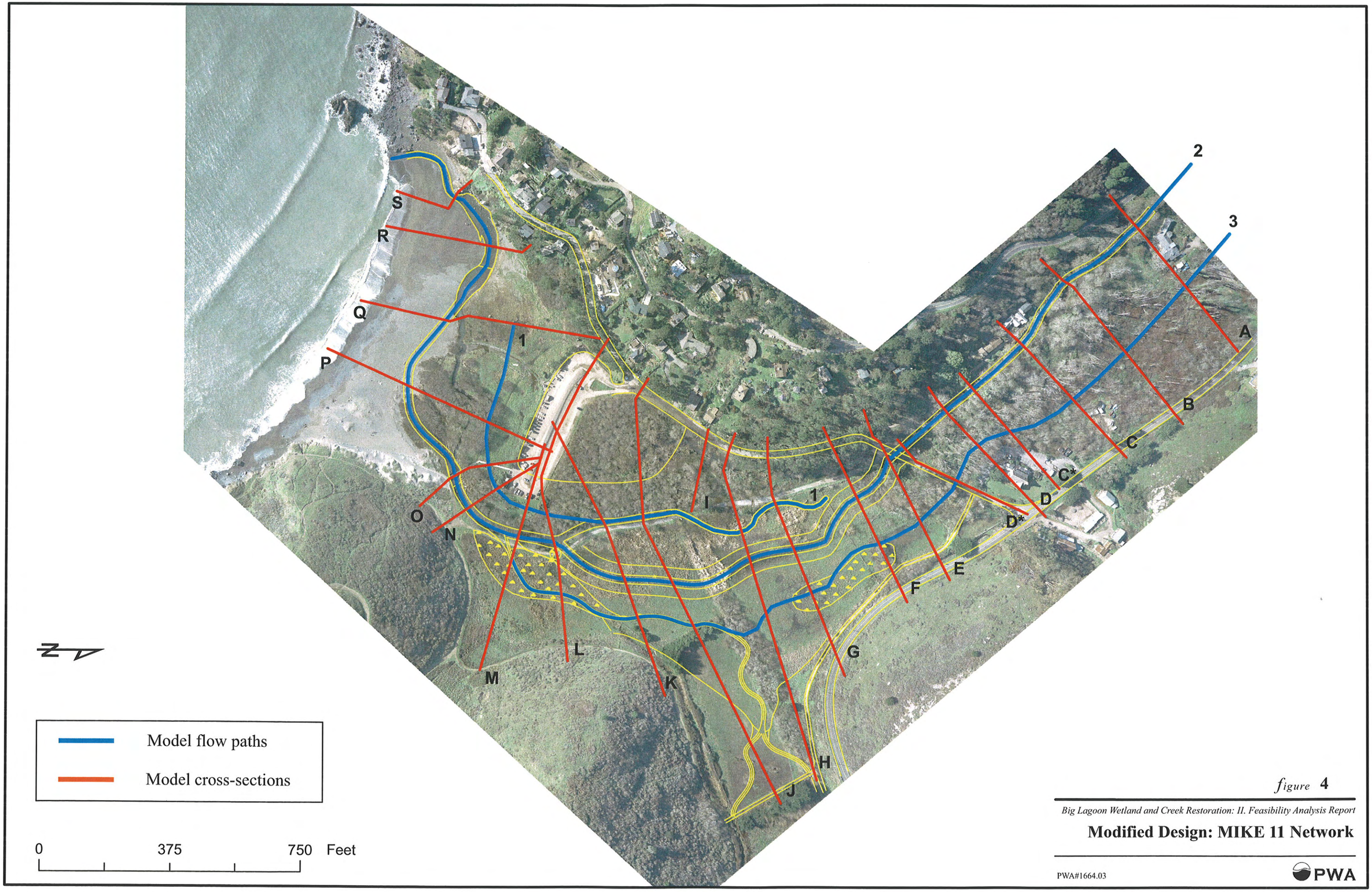


figure **4**

Big Lagoon Wetland and Creek Restoration: II. Feasibility Analysis Report

Modified Design: MIKE 11 Network

PWA#1664.03

PWA

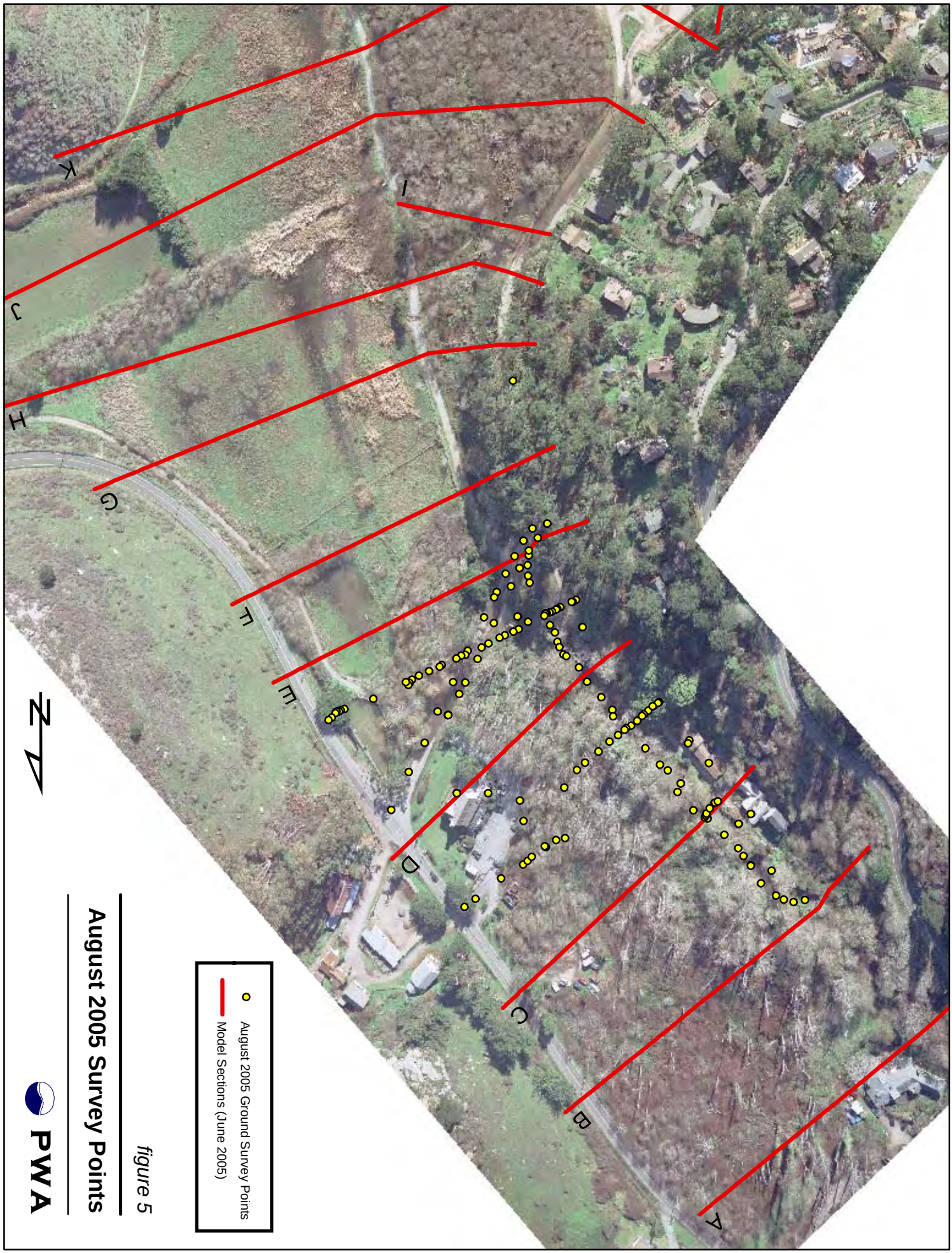
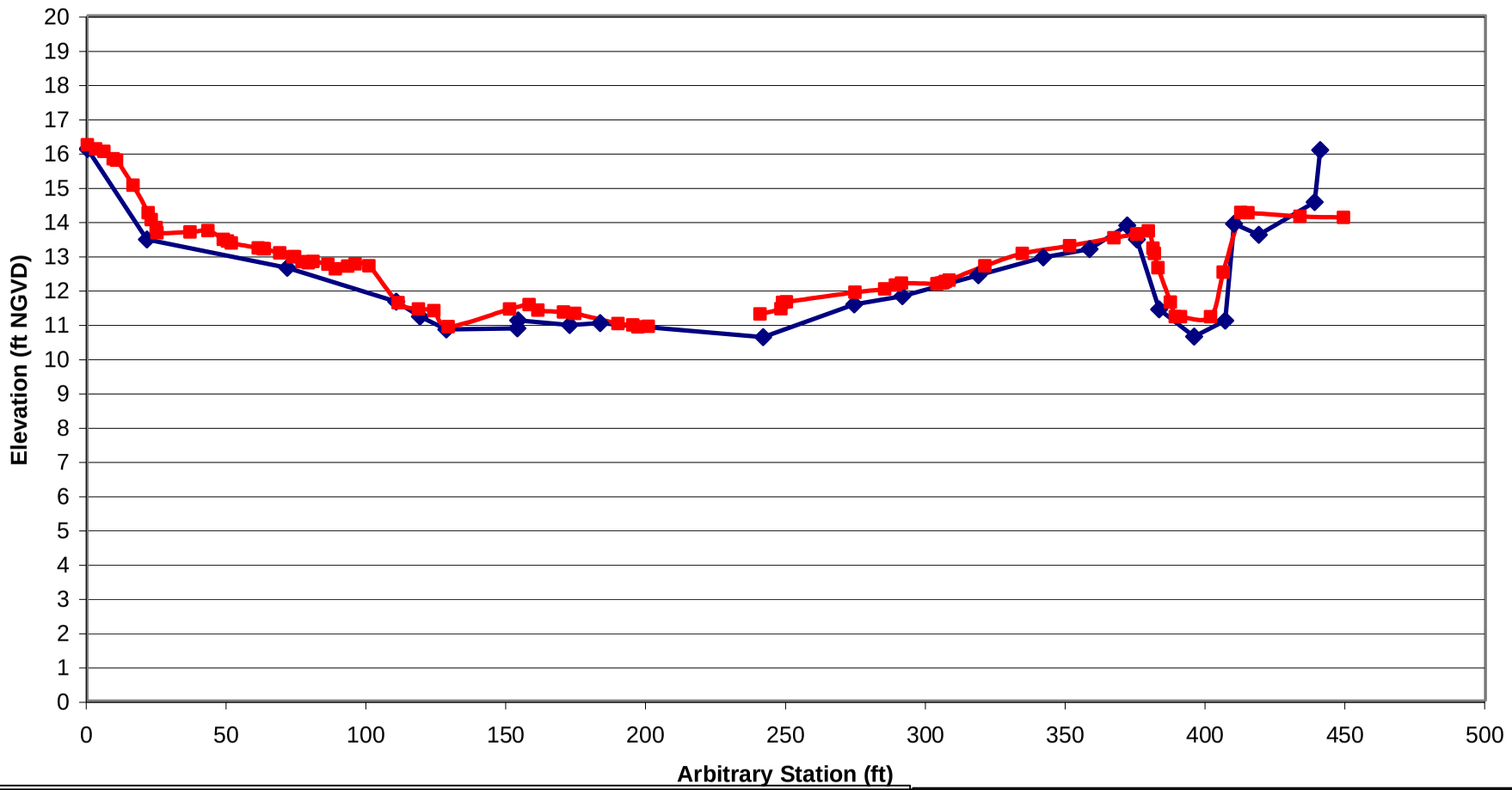


figure 5

August 2005 Survey Points

PWA



Notes: Using AutoCAD, a cross section was cut on the Towill, 2003 Digital Terrain Model (DTM) at the same location of the NPS August 2005 survey points. This figure compares the differences between the DTM and the survey points at the cross section labeled C*. The stationing is arbitrary.

NPS August 2005 Survey Points

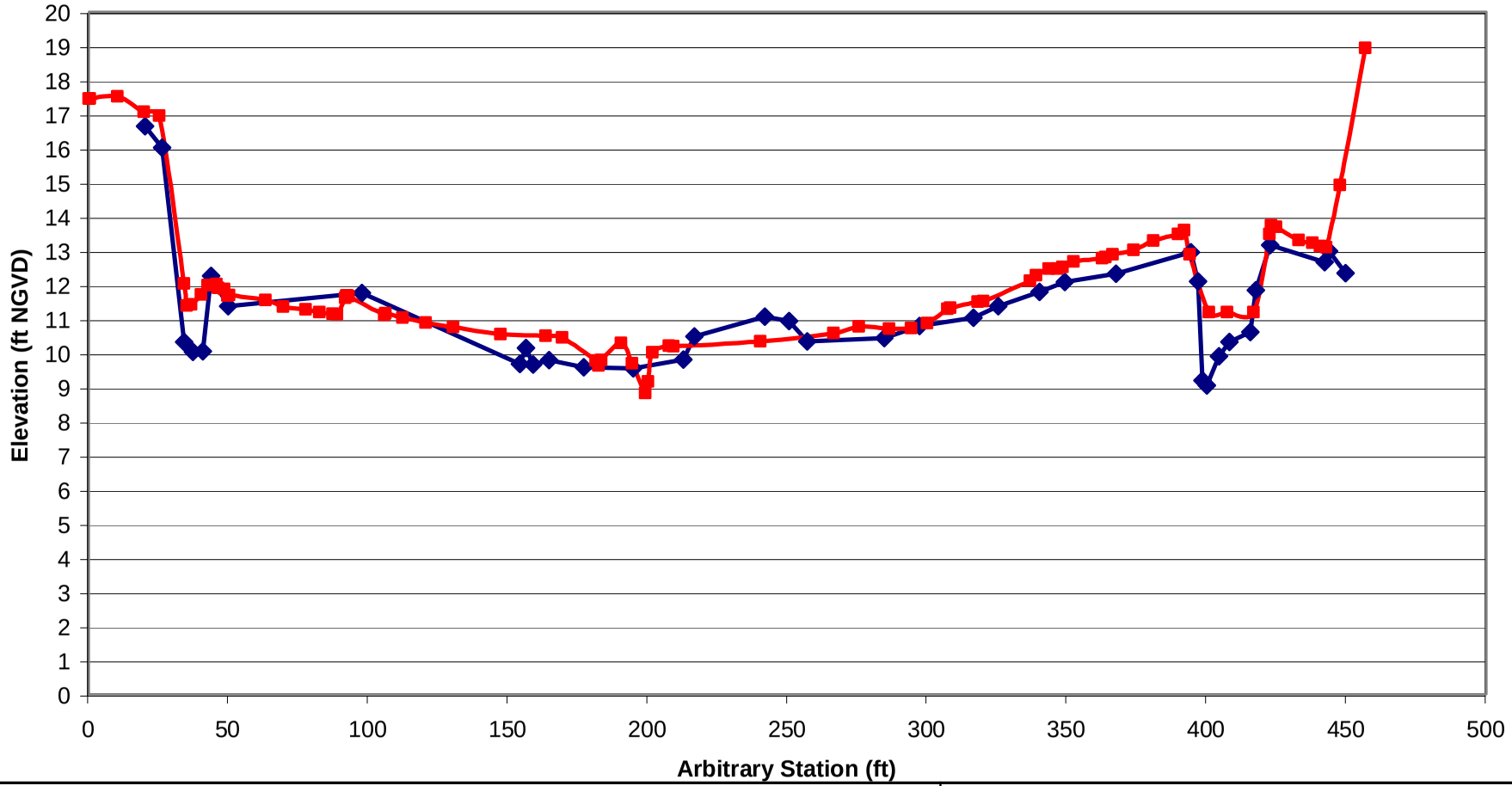
Cross Section Cut from Towill January 2003 DTM

figure 6

Comparison of 2005 Ground Survey & 2003 Aerial Survey - Section C*

PWA

PWA #: 1664.03



Notes: Using AutoCAD, a cross section was cut on the Towill, 2003 Digital Terrain Model (DTM) at the same location of the NPS August 2005 survey points. This figure compares the differences between the DTM and the survey points at the cross section labeled D*. The stationing is arbitrary.

NPS August 2005 Survey Points

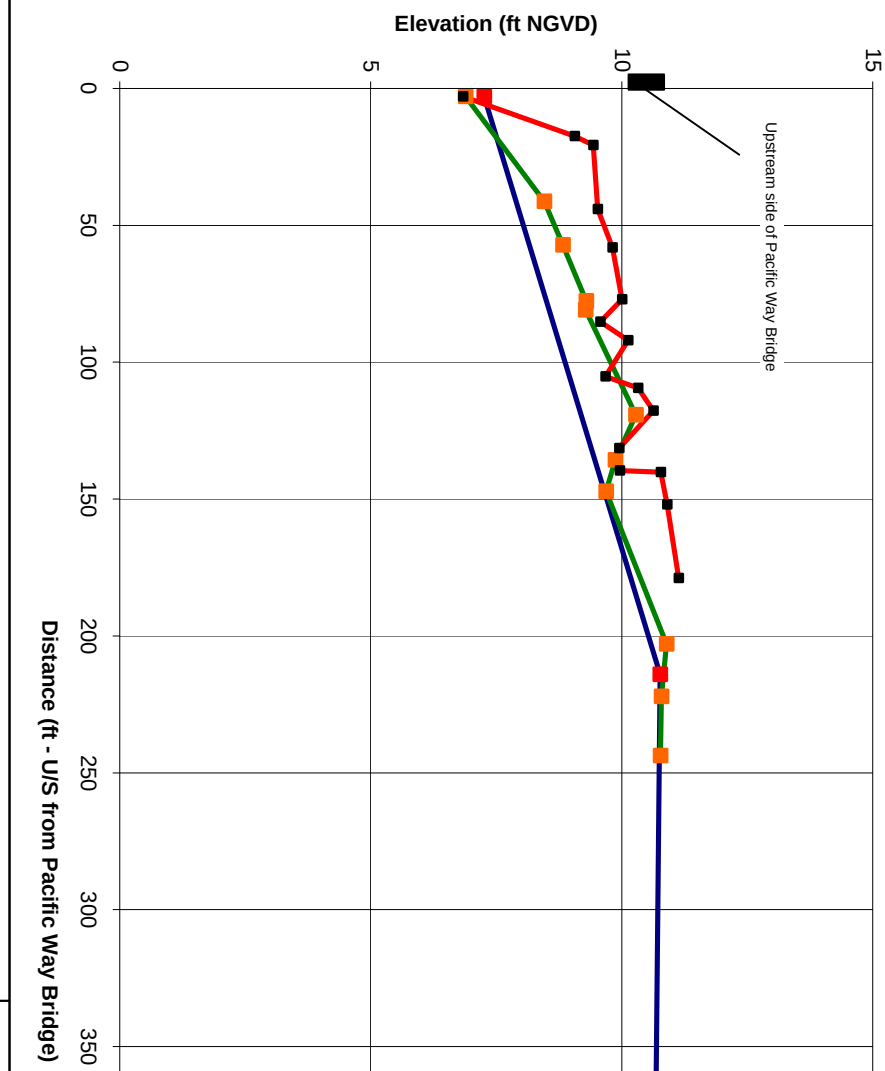
Cross Section Cut from Towill January 2003 DTM

figure 7

Comparison of 2005 Ground Survey & 2003 Aerial Survey - Section D*

PWA

PWA #: 1664.03



Apr-03
Aug-04
Feb-05

Environmental Data Solutions

Figure 8

Redwood Creek Thalweg Profile:
Upstream Chord ofPacific Way Bridge

April, 2003, August, 2004 and February, 2005

Q:\Projects\1664.02_BIG_LAGOON_COST_EST\MODEL\Bridge_Plan.dwg 10-05-05 10:53:26 AM e.wisnosky

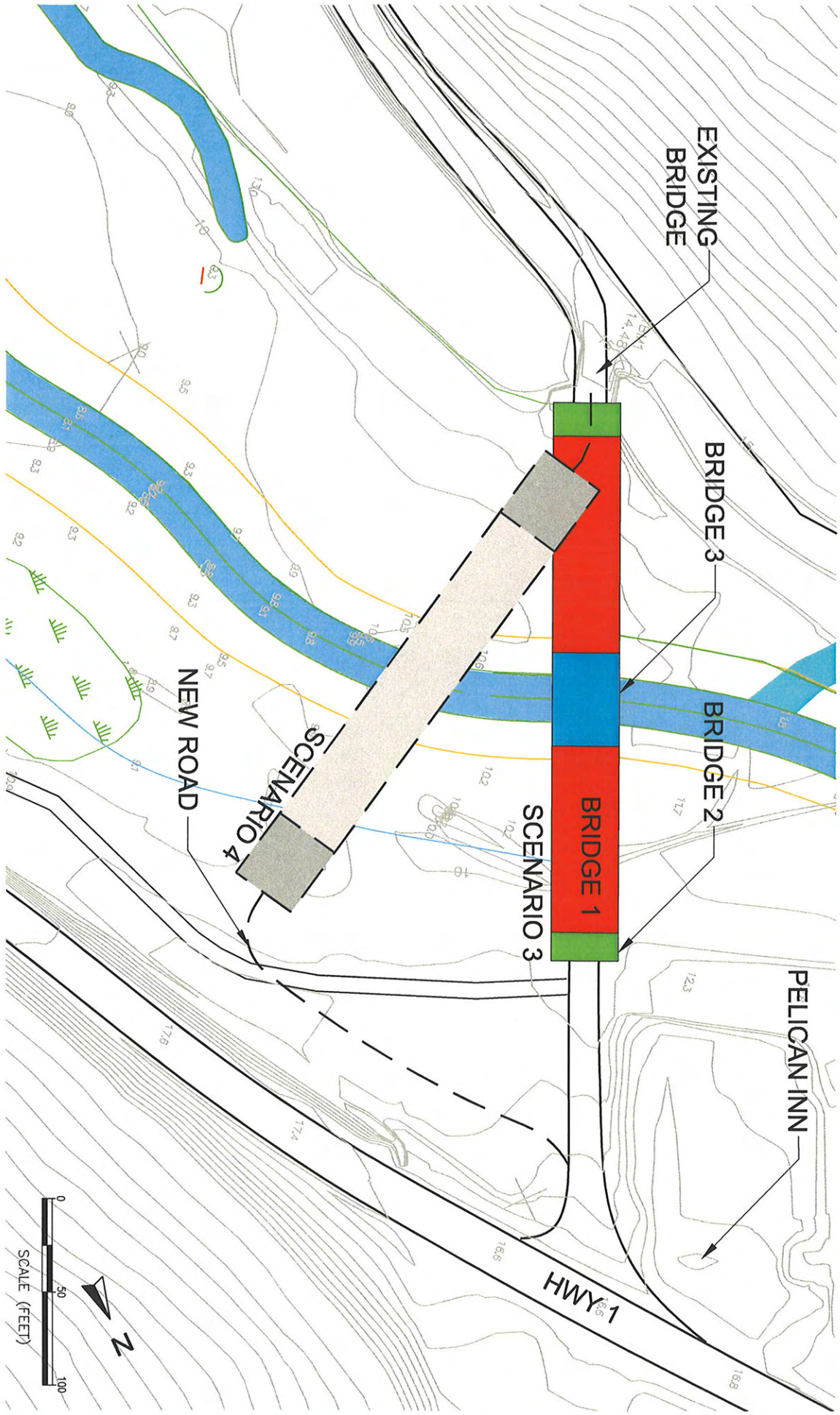


figure 9

Bridge Options for Scenarios 3&4

PWA

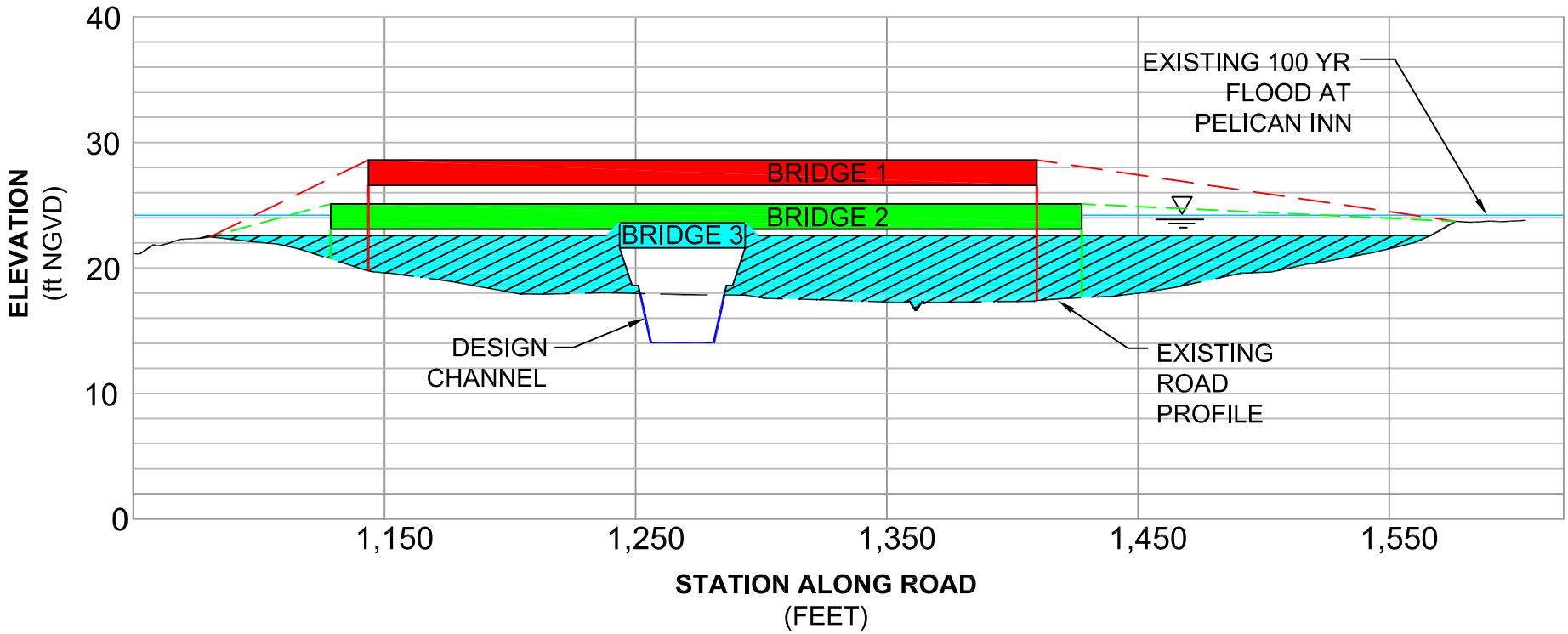
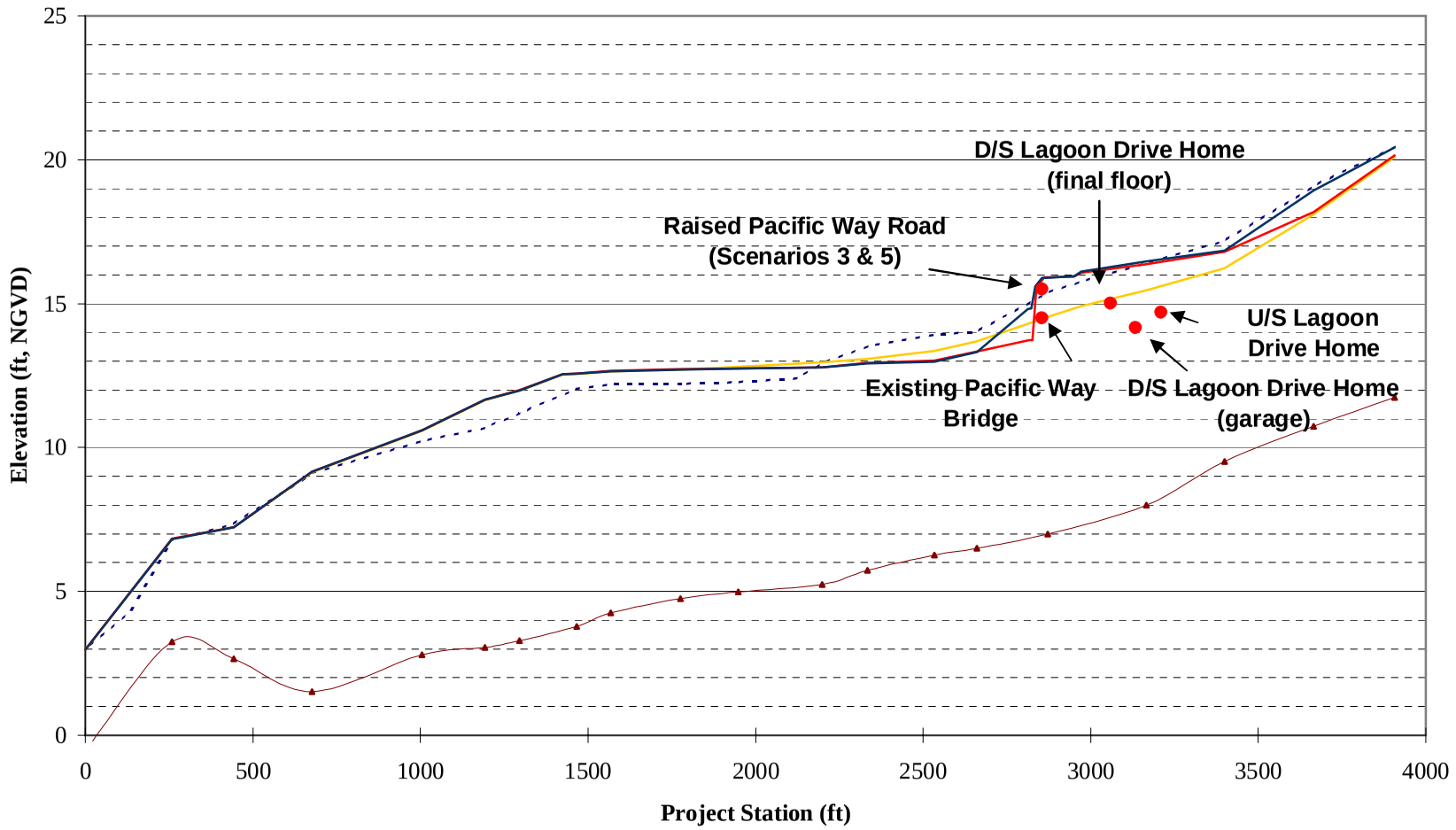


figure ***10***

Bridge Options for Scenario 3:
Creek Restoration and New Bridge

NOTE: Location of Bridge Alternatives Shown Relative to Existing Road Profile

Q:\Projects\1664.02_BIG_LAGOON_COST_EST\MODEL\Bridge_XS.dwg 4-05-06 02:24:24 PM e.wisnosky



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. All cross sections are in the same locations for each alternative, however distances between cross sections may be different between each alternative. Scenario 3 is the raised road with the bridge in the center of the floodplain.

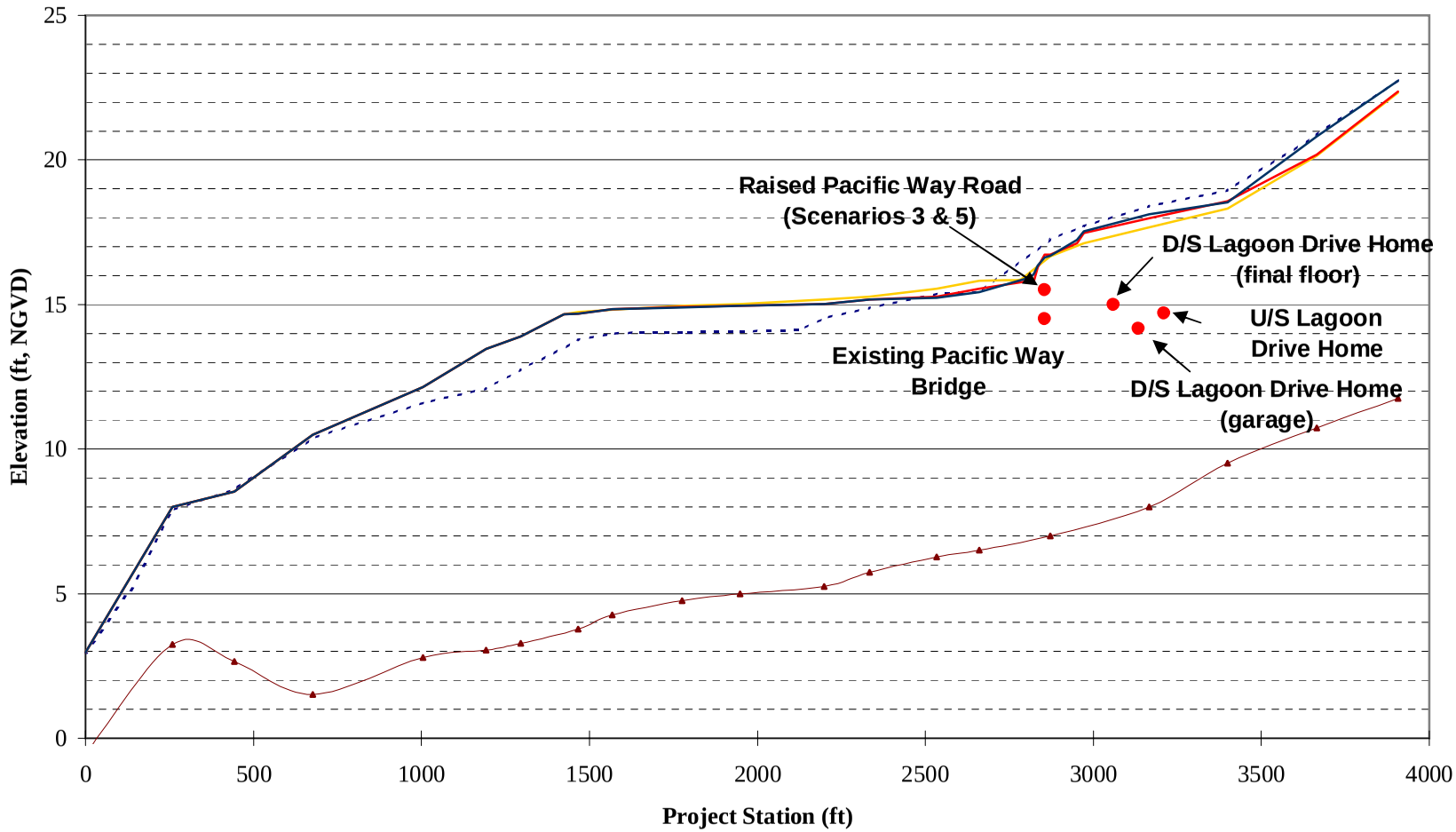
- Scenario 1: No Action
- Scenario 2: No Bridge
- Scenario 3: Alt 2
- Scenario 5: Modified Design
- Alternative 2 Thalweg
- Spot Elevations

figure 11

Comparison of Water Levels on the Righ Floodplain during the 10-Year Flow

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. All cross sections are in the same locations for each alternative, however distances between cross sections may be different between each alternative. Scenario 3 is the raised road with the bridge in the center of the floodplain.

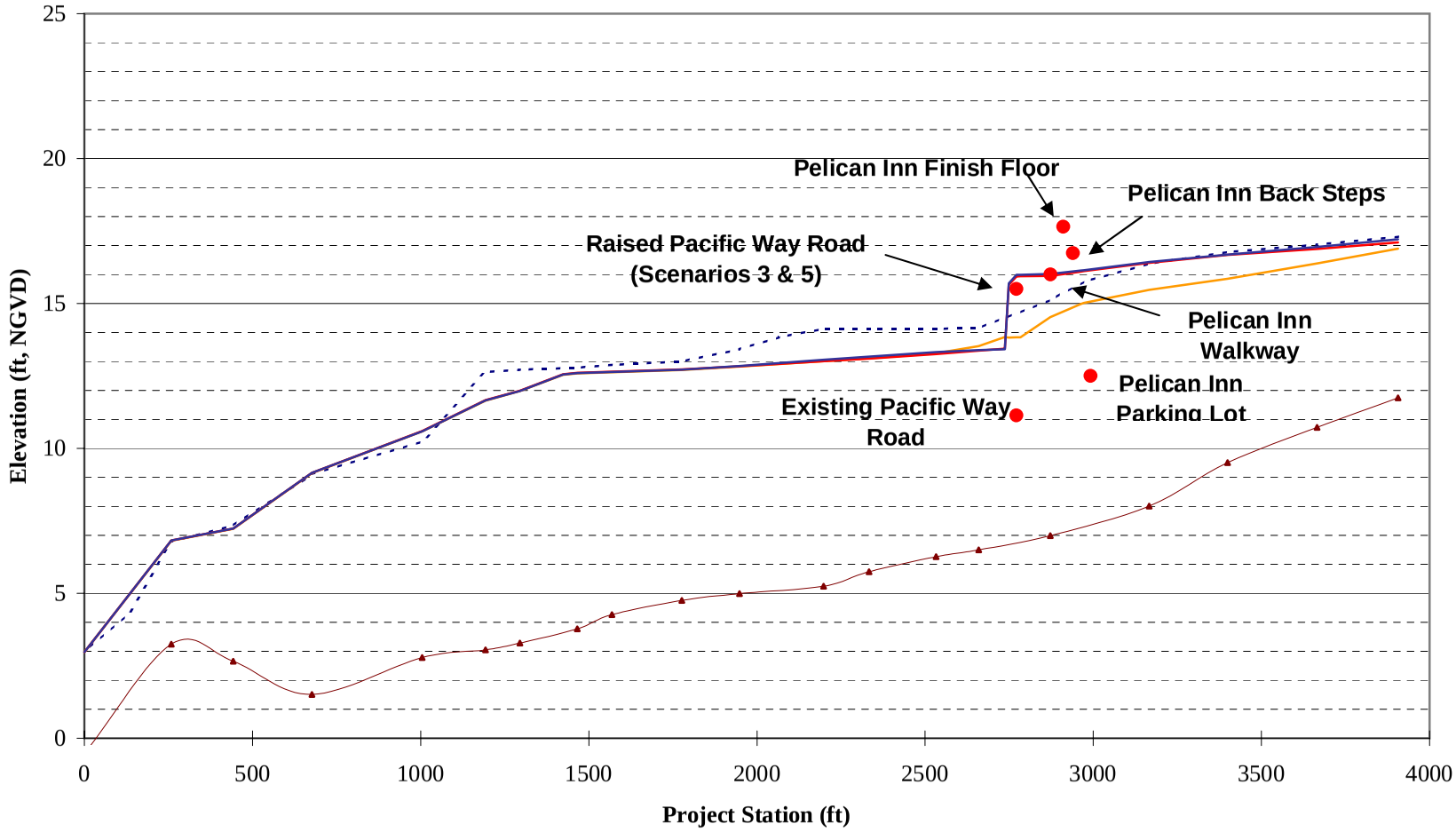
- Scenario 1: No Action
- Scenario 2: No Bridge
- Scenario 3: Alt 2
- Scenario 5: Modified Design
- Alternative 2 Thalweg
- Spot Elevations

figure 12

Comparison of Water Levels on the Righ Floodplain during the 100-Year Flow

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. All cross sections are in the same locations for each alternative, however distances between cross sections may be different between each alternative. Scenario 3 is the raised road with the bridge in the center of the floodplain.

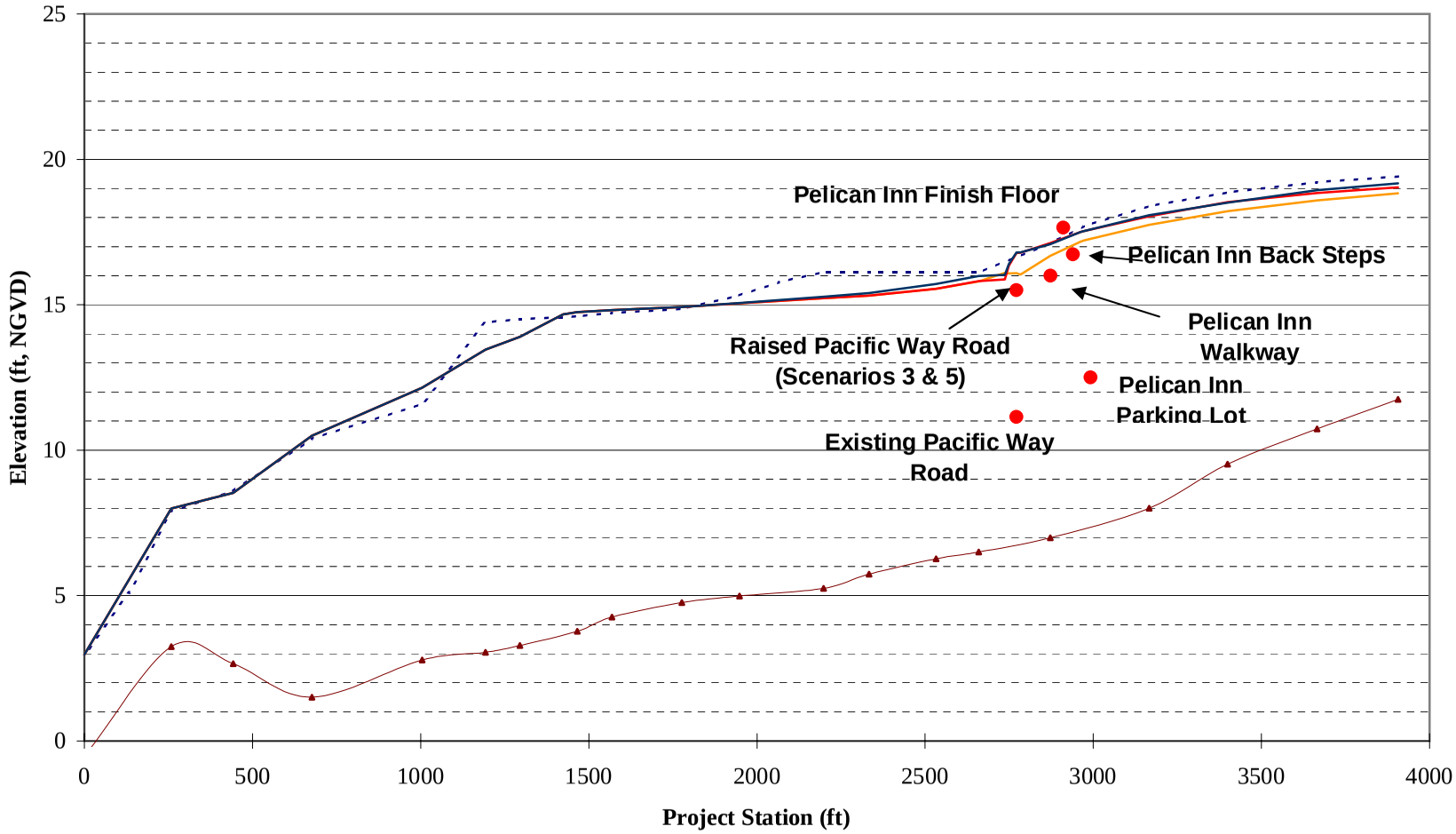
- Scenario 1: No Action
- Scenario 2: No Bridge
- Scenario 3: Alt 2
- Scenario 5: Modified Design
- Alternative 2 Thalweg
- Spot Elevations

figure 13

Comparison of Water Levels on the Left Floodplain during the 10-Year Flow

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. All cross sections are in the same locations for each alternative, however distances between cross sections may be different between each alternative. Scenario 3 is the raised road with the bridge in the center of the floodplain.

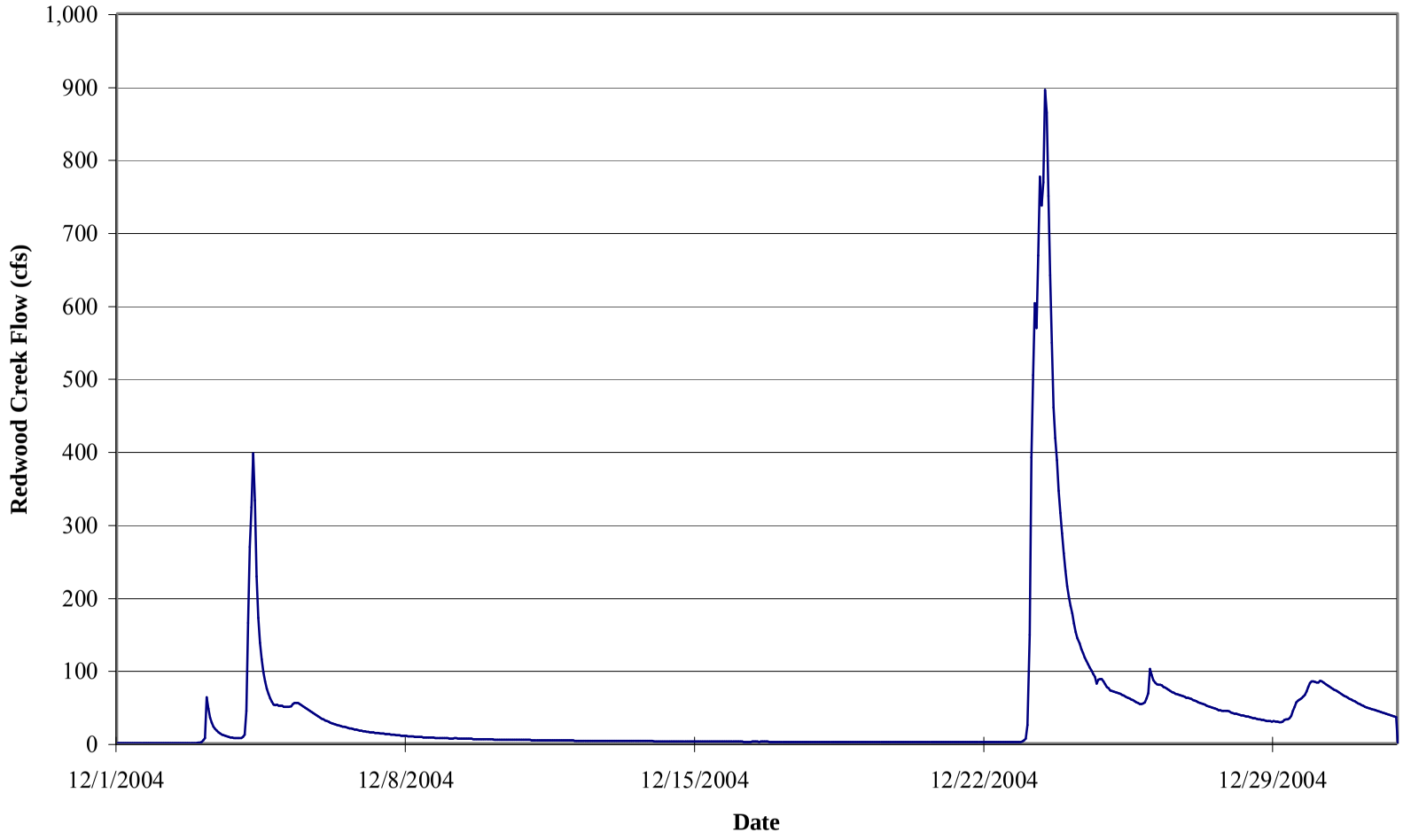
- Scenario 1: No Action
- Scenario 2: No Bridge
- Scenario 3: Alt 3
- Scenario 5: Modified Design
- Alternative 2 Thalweg
- Spot Elevations

figure 14

Comparison of Water Levels on the Left Floodplain during the 100-Year Flow

PWA

PWA #: 1664.03



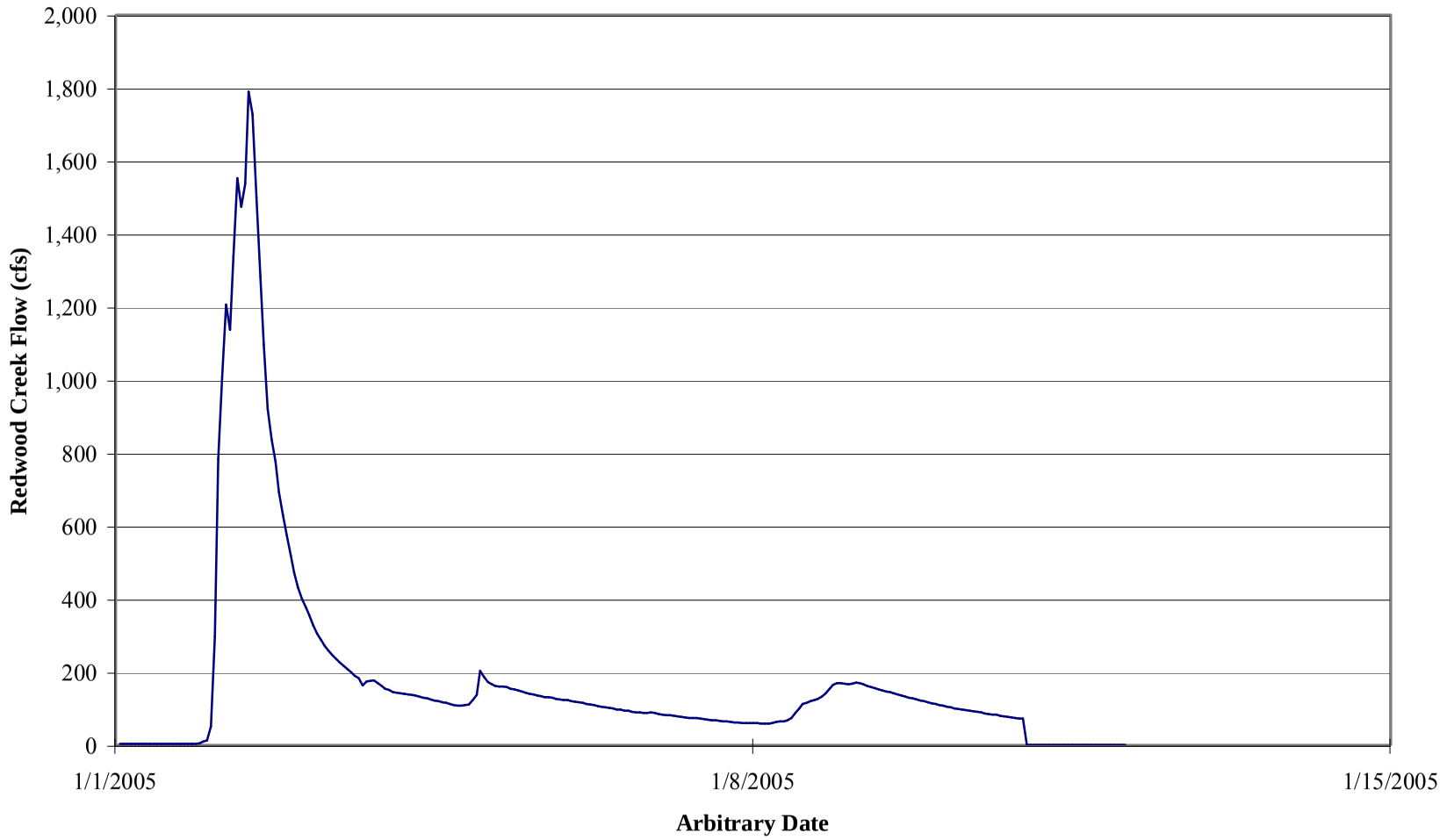
Flow values based on stage data at Highway 1 Bridge. For this period, the Qmax = 895 cfs, which is approximately a 2-Year event.

figure 15

Redwood Creek December 2004 Flow Data for Sediment Loading Simulation

PWA

PWA #: 1664.03



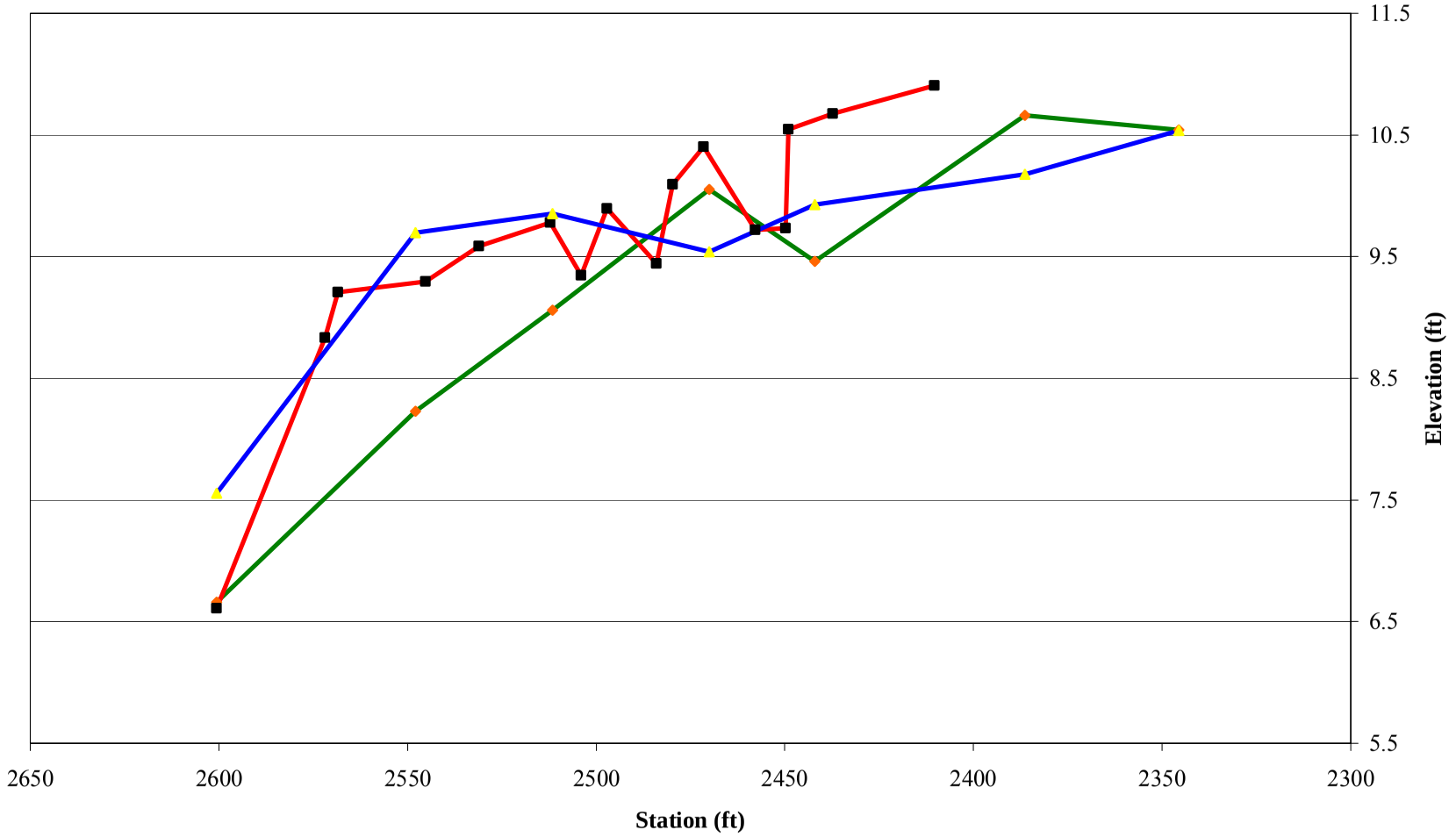
Flow values are double that of the Water Year 2005 Q2 event. For this period, the Qmax = 1790 cfs, which is approximately a 6-Year event.

figure 16

Approx 6-Year Event on Redwood Creek Used for Sediment Loading Simulation

PWA

PWA #: 1664.03



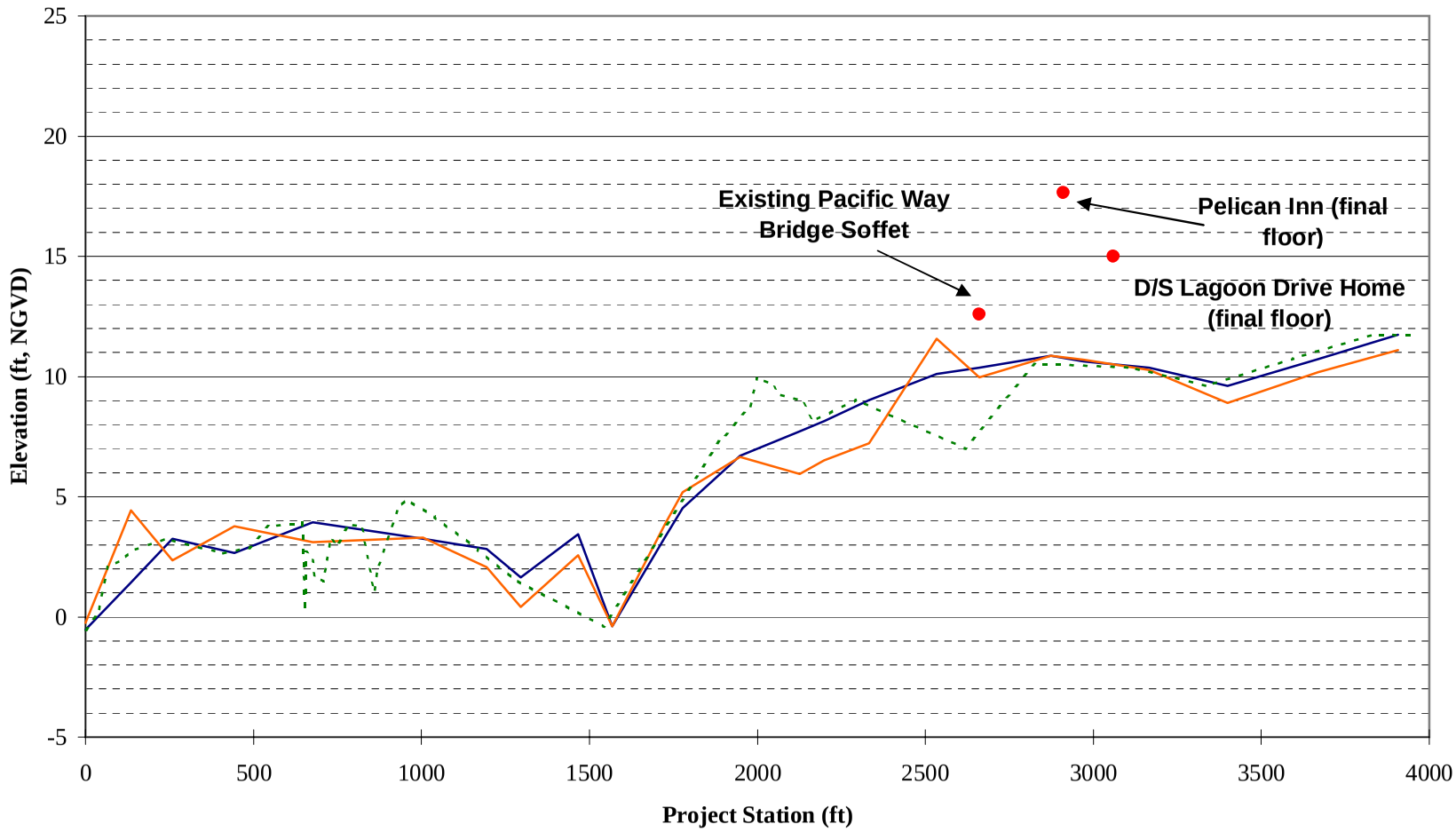
August 2004 Thalweg
February 2005 Thalweg
Calibration Results

figure 17

Redwood Creek Sediment Transport
Model Calibration for Existing Conditions

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. "Typical" sediment loading based on Water Year 2005 hydrograph from Dec 1st to January 18th (Qmax = 895 cfs) and Redwood Creek sediment data (Stillwater, 2004).

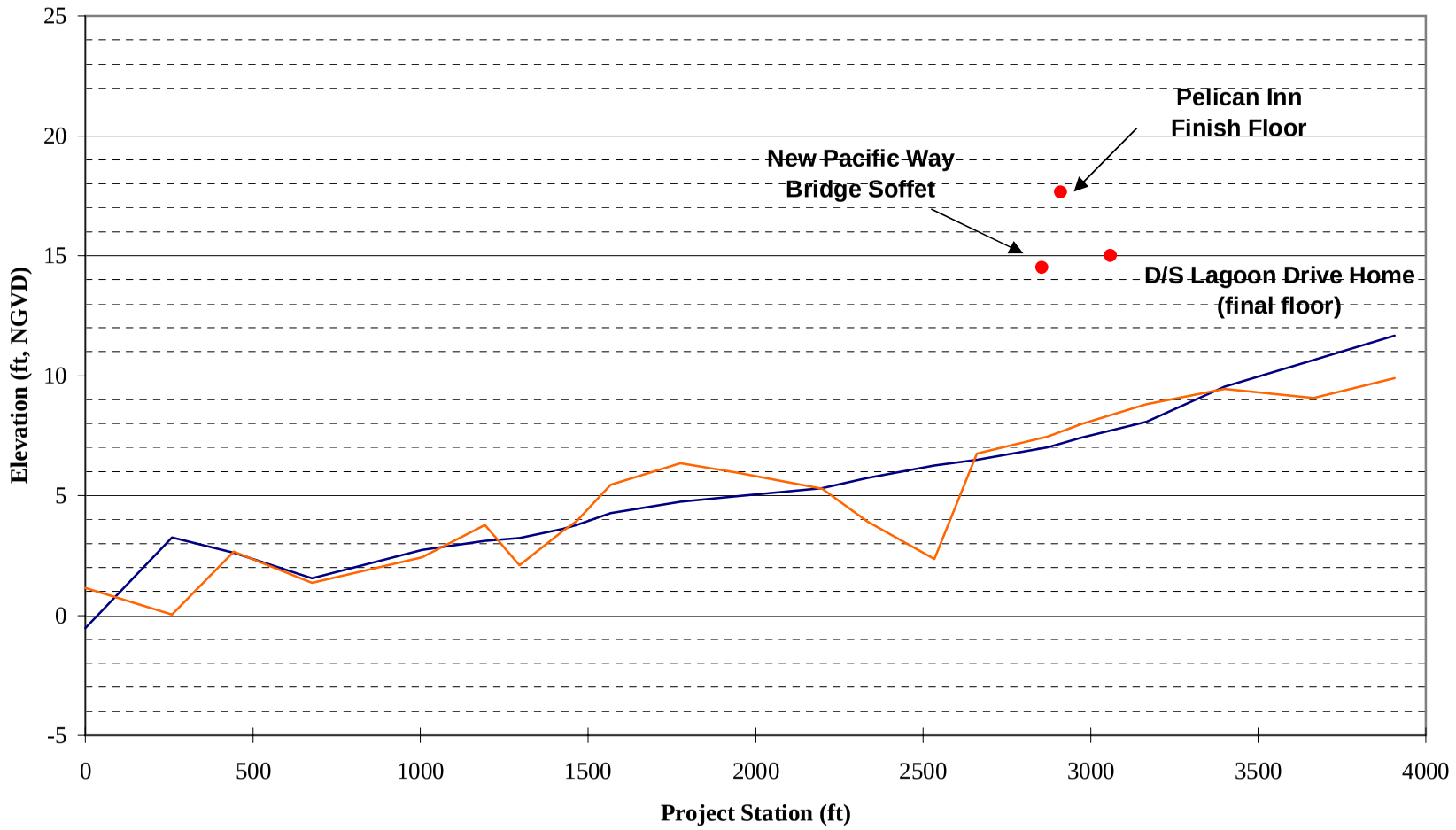
Initial Thalweg
Post-Simulation Thalweg
Post-Dredge (2003) Thalweg
Spot Elevations

figure 18

Five Years of "Typical" Sediment Loading: Alternative 1- No Action

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. "Typical" sediment loading based on Water Year 2005 hydrograph from Dec 1st to January 18th (Qmax = 895 cfs) and Redwood Creek sediment data (Stillwater, 2004).

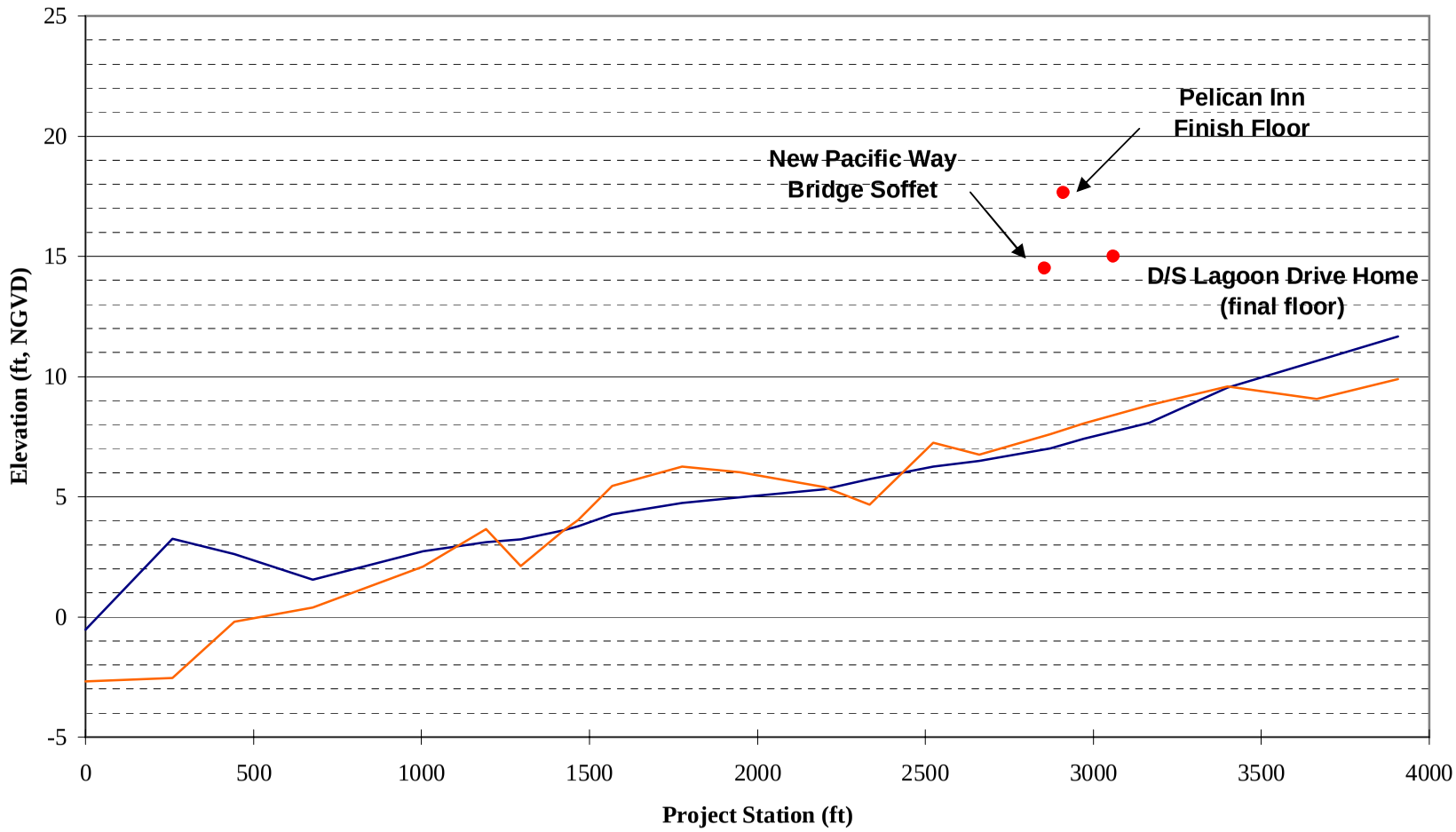
Initial Thalweg | Post-Simulation Thalweg | Spot Elevations

figure 19

Five Years of "Typical" Sediment Loading
Alternative 2- Creek Restoration and 50 foot Bridge

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. "Typical" sediment loading based on Water Year 2005 hydrograph from Dec 1st to January 18th (Qmax = 895 cfs) and Redwood Creek sediment data (Stillwater, 2004).

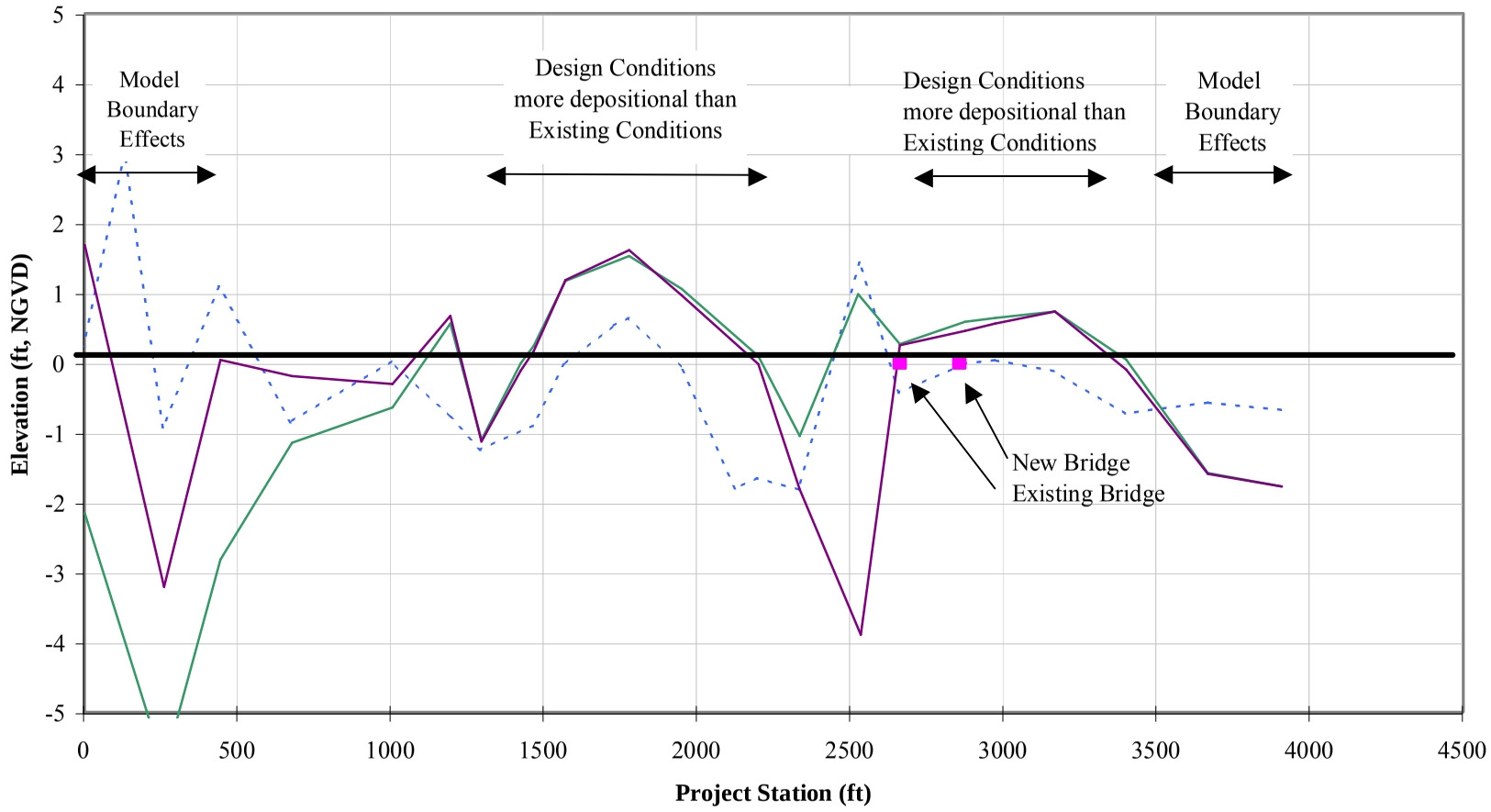
Initial Thalweg | Post-Simulation Thalweg | Spot Elevations

figure 20

Five Years of "Typical" Sediment Loading
Alternative 2- Creek Restoratio
and 150 foot Bridge

PWA

PWA #: 1664.03



Notes: Chainages based on Alternative 1 MIKE network. Bed change is the difference between pre- and post-simulation thalweg elevation. Positive values indicate deposition and negative values indicate erosion.

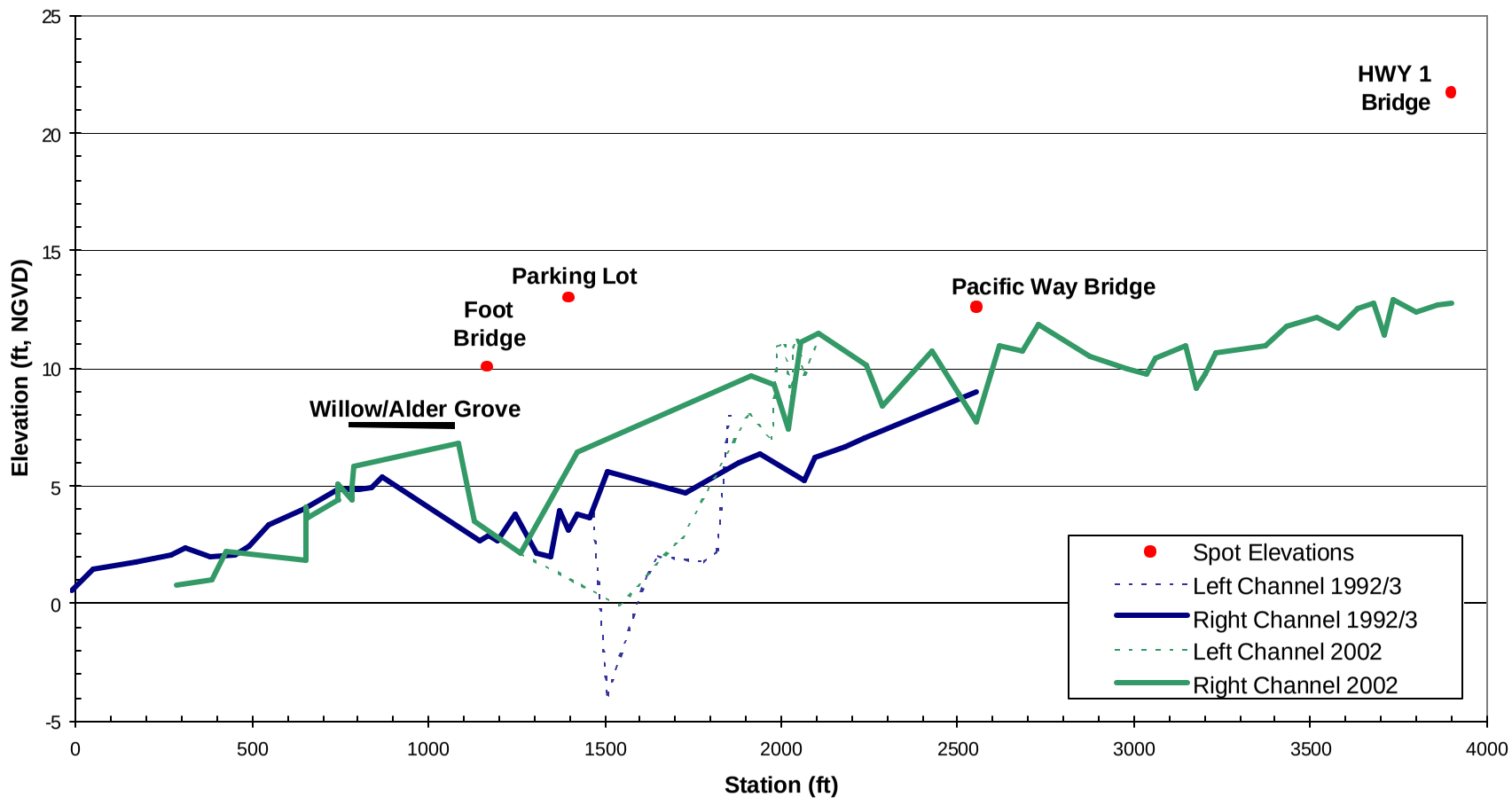
- Bed Change - Existing Conditions (Alt 1)
- Bed Change - Design Conditions (Alt 2, 150-ft Bridge)
- Bed Change - Design Conditions (Alt 2, 50-ft Bridge)
- Spot Elevations

figure 21

Comparison of Bed Changes for Existing and Design Conditions (Five Years of "Typical" Sediment Loading)

PWA

PWA #: 1664.03



Sources:
1992 Survey, (PWA, 1994)
2002 Survey, (NPS, 2002)
Note:
Between stations 1300 and 2000, Redwood Creek is a two channel system.

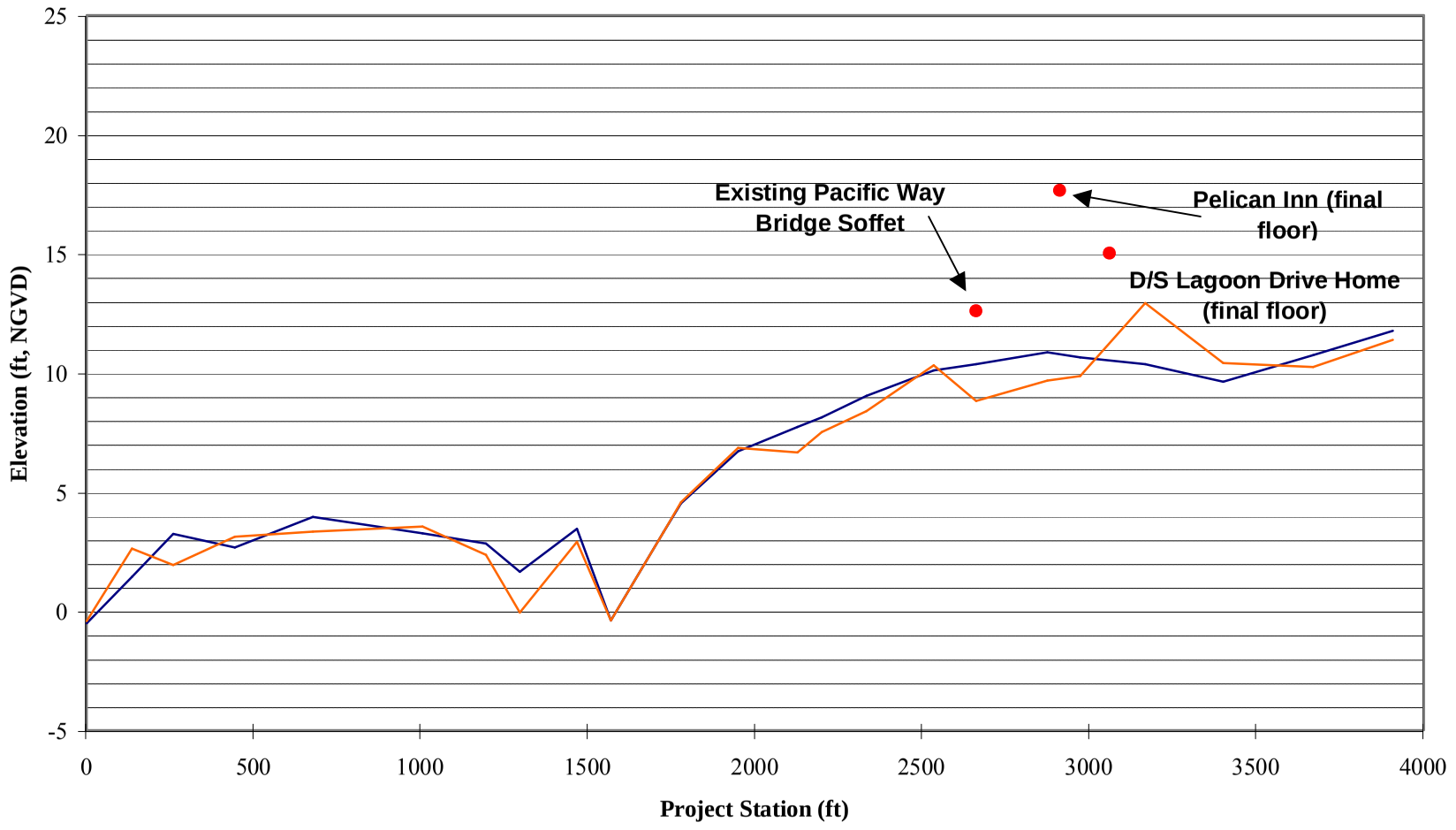
figure **22**

Big Lagoon Wetland and Creek Restoration: I. Site Analysis Report

Redwood Creek Thalweg: 1992 vs. 2002

PWA Ref #1664.02

PWA



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. Sediment loading based on synthetic hydrograph for one event (Qmax = 1790 cfs) and Redwood Creek sediment rating data (Stillwater, 2004)

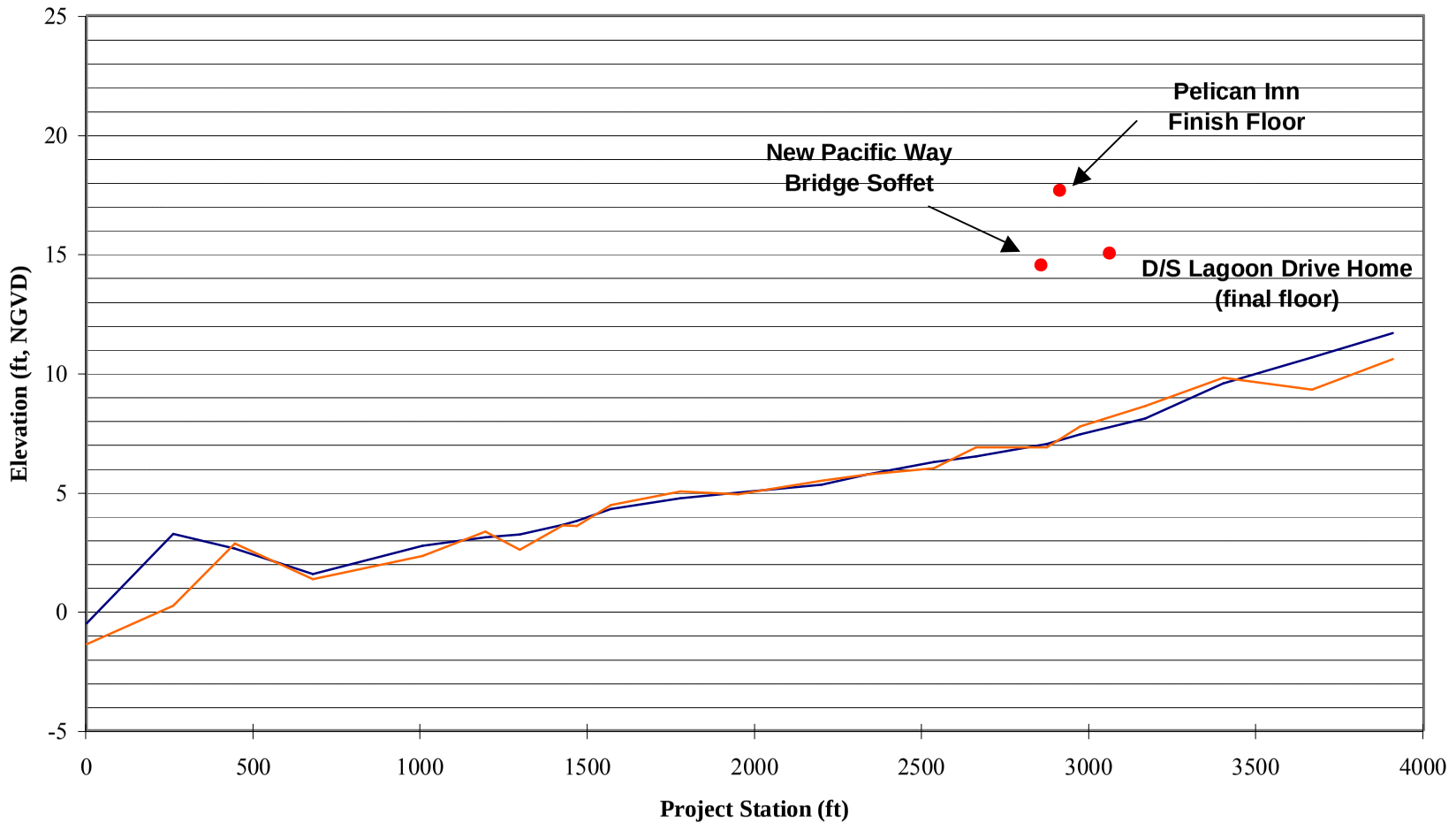
Initial Thalweg | Post-Simulation Thalweg | Spot Elevations

figure 23

Sediment Loading for Approx. 6-Year Event: Alternative 1- No Action

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. Sediment loading based on synthetic hydrograph for one event (Qmax = 1790 cfs) and Redwood Creek sediment rating data (Stillwater, 2004)

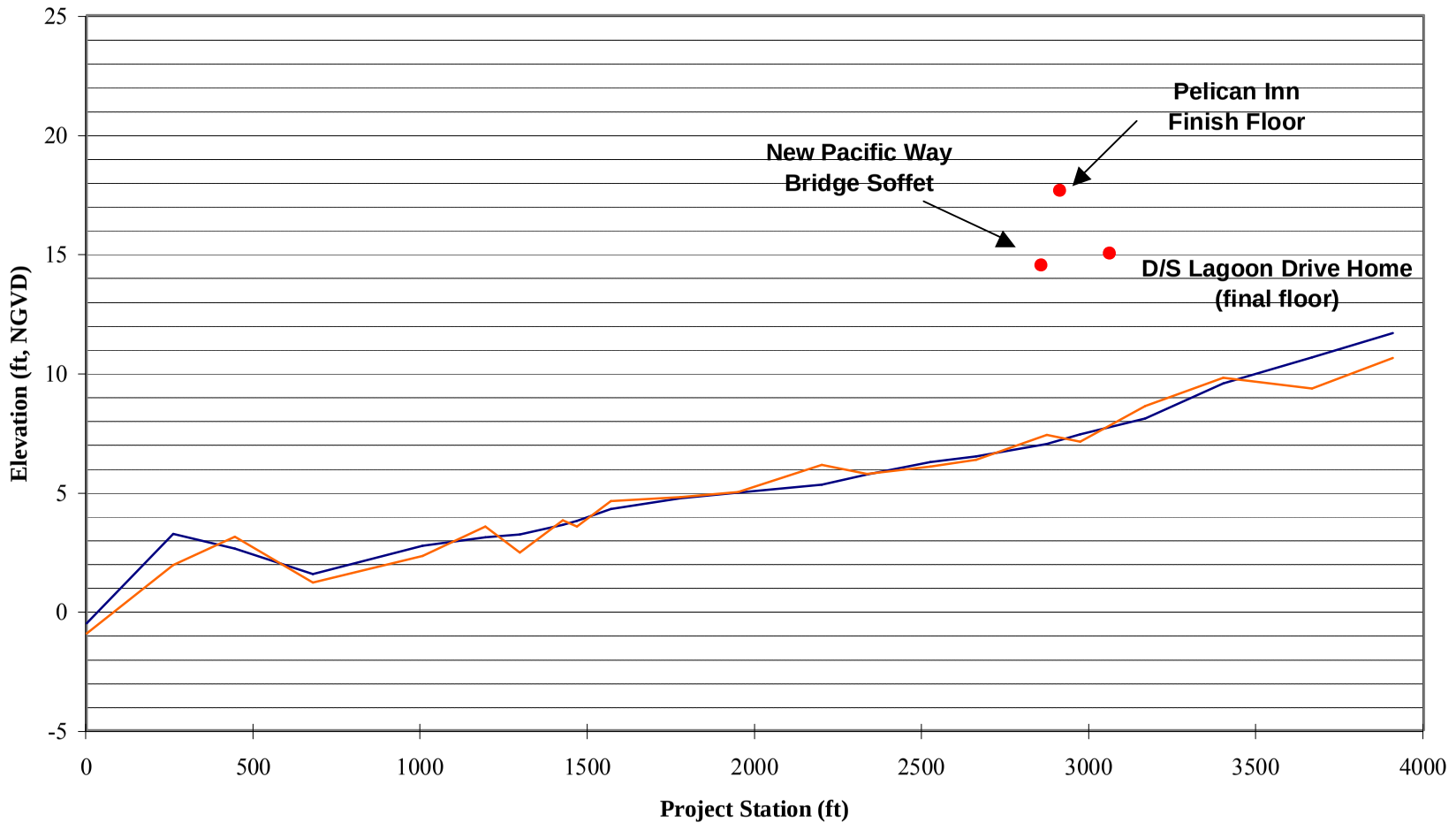
Initial Thalweg | Post-Simulation Thalweg | Spot Elevations

figure 24

Sediment Loading for Approx 6-Year Event: Alternative 2- Creek Restoration and 50 foot Bridge

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. Sediment loading based on synthetic hydrograph for one event (Qmax = 1790 cfs) and Redwood Creek sediment rating data (Stillwater, 2004)

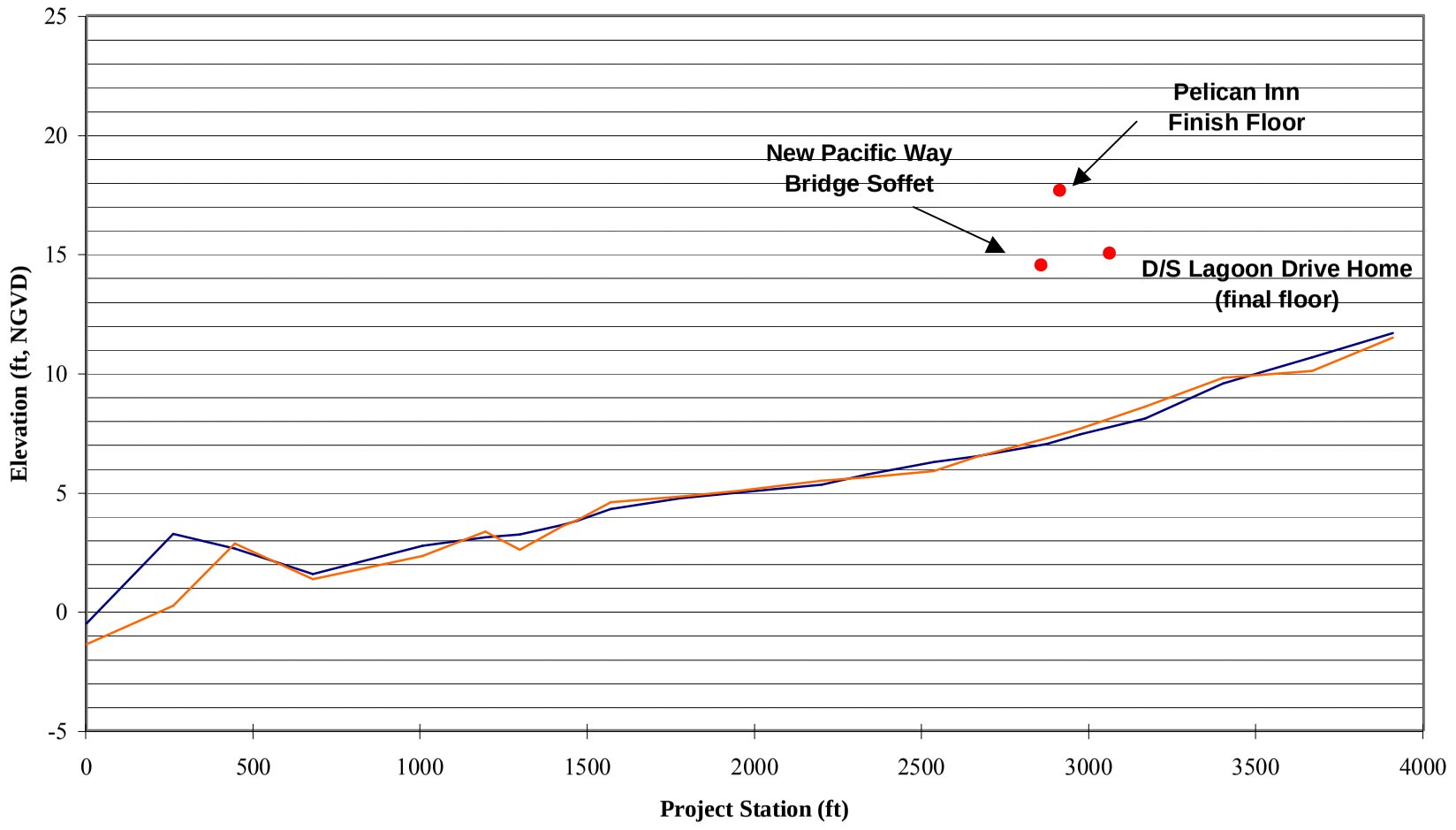
Initial Thalweg | Post-Simulation Thalweg | Spot Elevations

figure 25

Sediment Loading for Approx 6-Year Event: Alternative 2- Creek Restoration and 150 foot Bridge

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. Sediment loading based on synthetic hydrograph for one event (Qmax = 1790 cfs) and Redwood Creek sediment rating data (Stillwater, 2004)

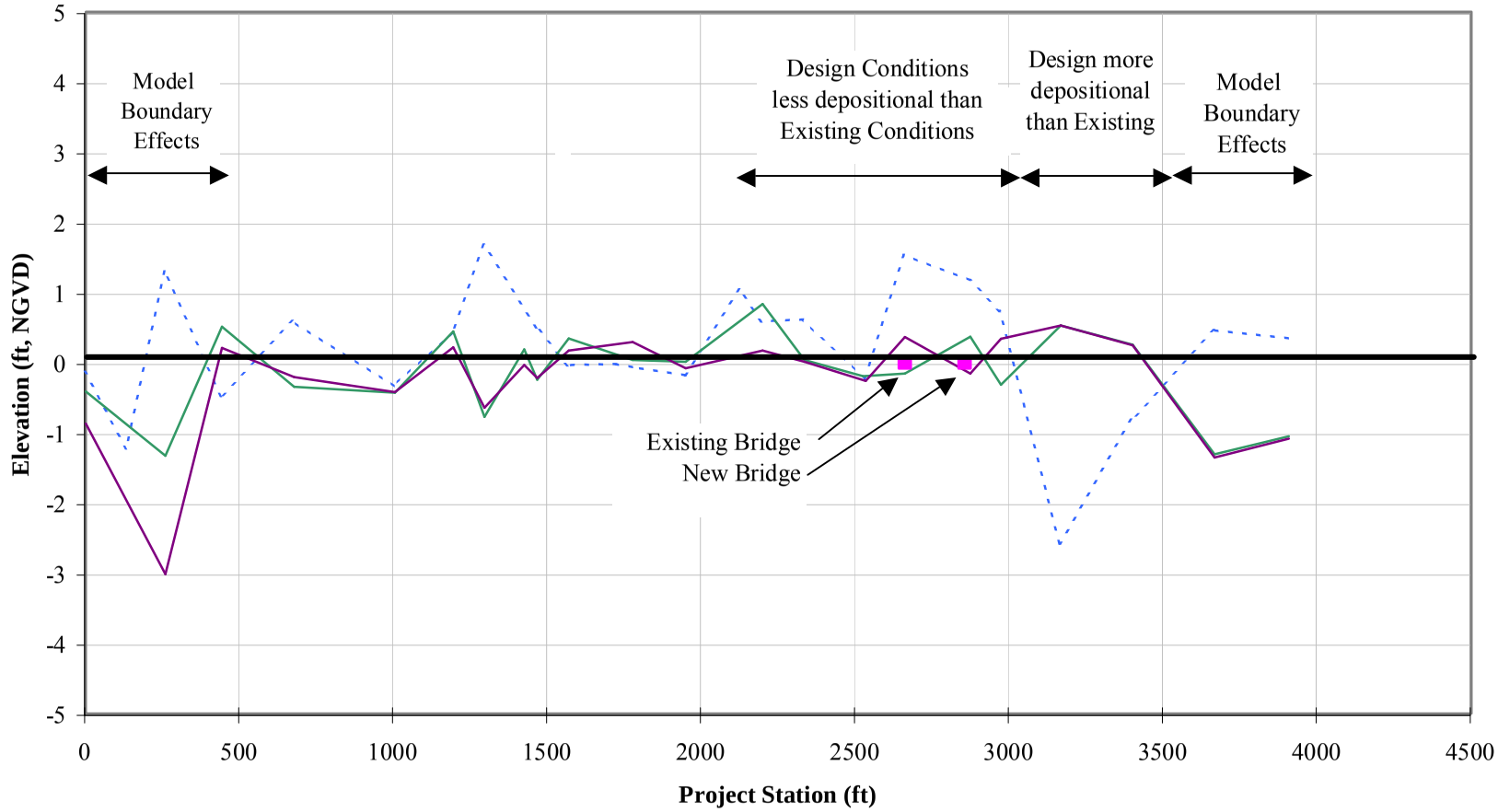
Initial Thalweg | Post-Simulation Thalweg | Spot Elevations

figure 26

Sediment Loading for Approx 6-Year Event: Alternative 2- Creek Restoration and 50 foot Bridge (extended upstream boundary)

PWA

PWA #: 1664.03



Notes: Chainages based on Alternative 1 MIKE network. Bed change is the difference between pre- and post-simulation thalweg elevation. Positive values indicate deposition and negative values indicate erosion.

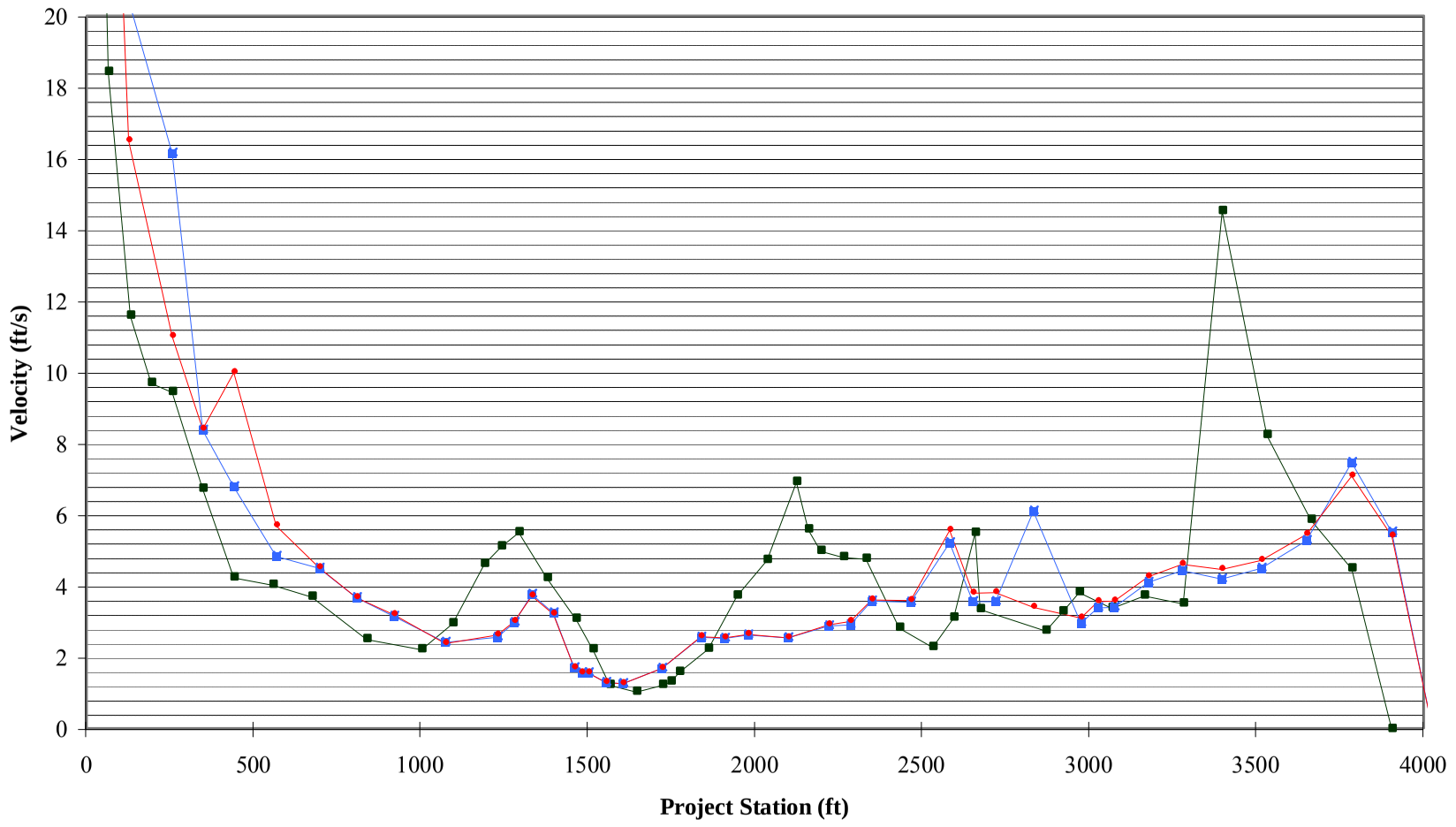
- Bed Change - Existing Conditions (Alt 1)
- Bed Change - Design Conditions (Alt 2, 150-ft Bridge)
- Bed Change - Design Conditions (Alt 2, 50-ft Bridge)
- Spot Elevations

figure 27

Comparison of Bed Changes for Existing and Design Conditions (Approx 6 -Year Event Sediment Loading)

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network.

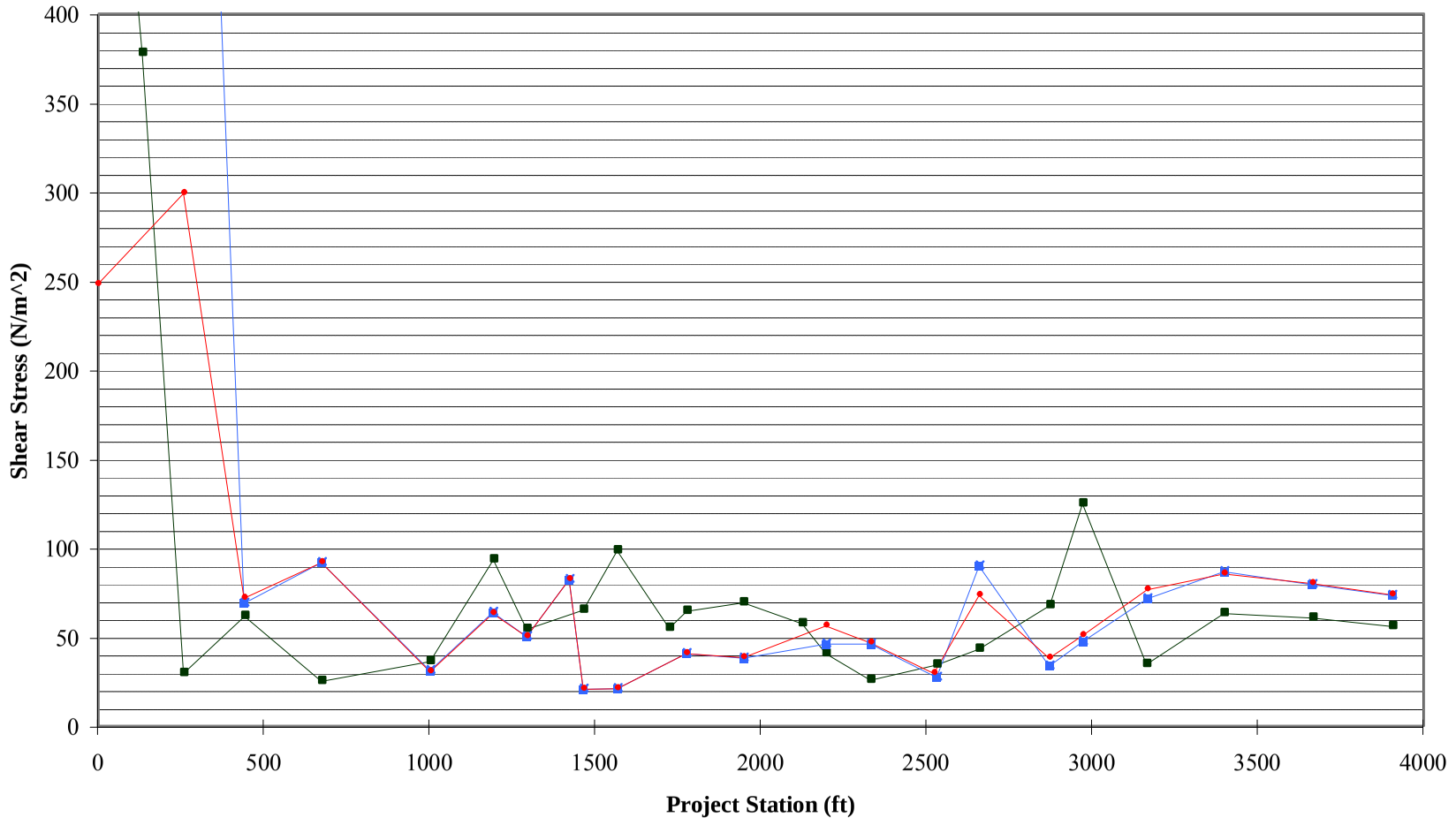
A1 Q6 — A2 50' Q6 — A2 150' Q6

figure 28

Maximum Velocity Values for Sediment Transport Simulations

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network.

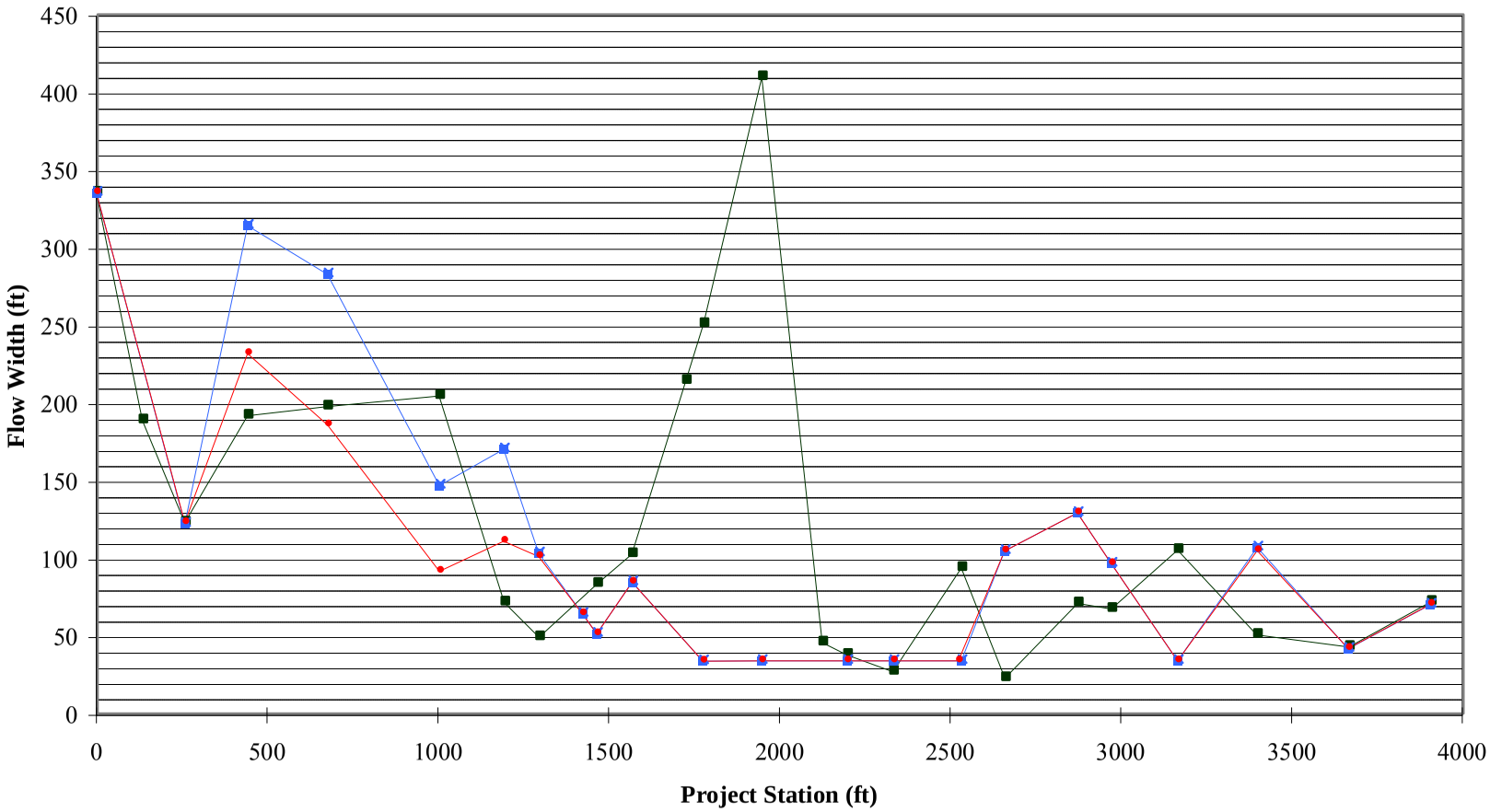
A1 Q6 — A2 50' Q6 — A2 150' Q6

figure 29

Maximum Shear Stress Values for Sediment Transport Simulations

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network.

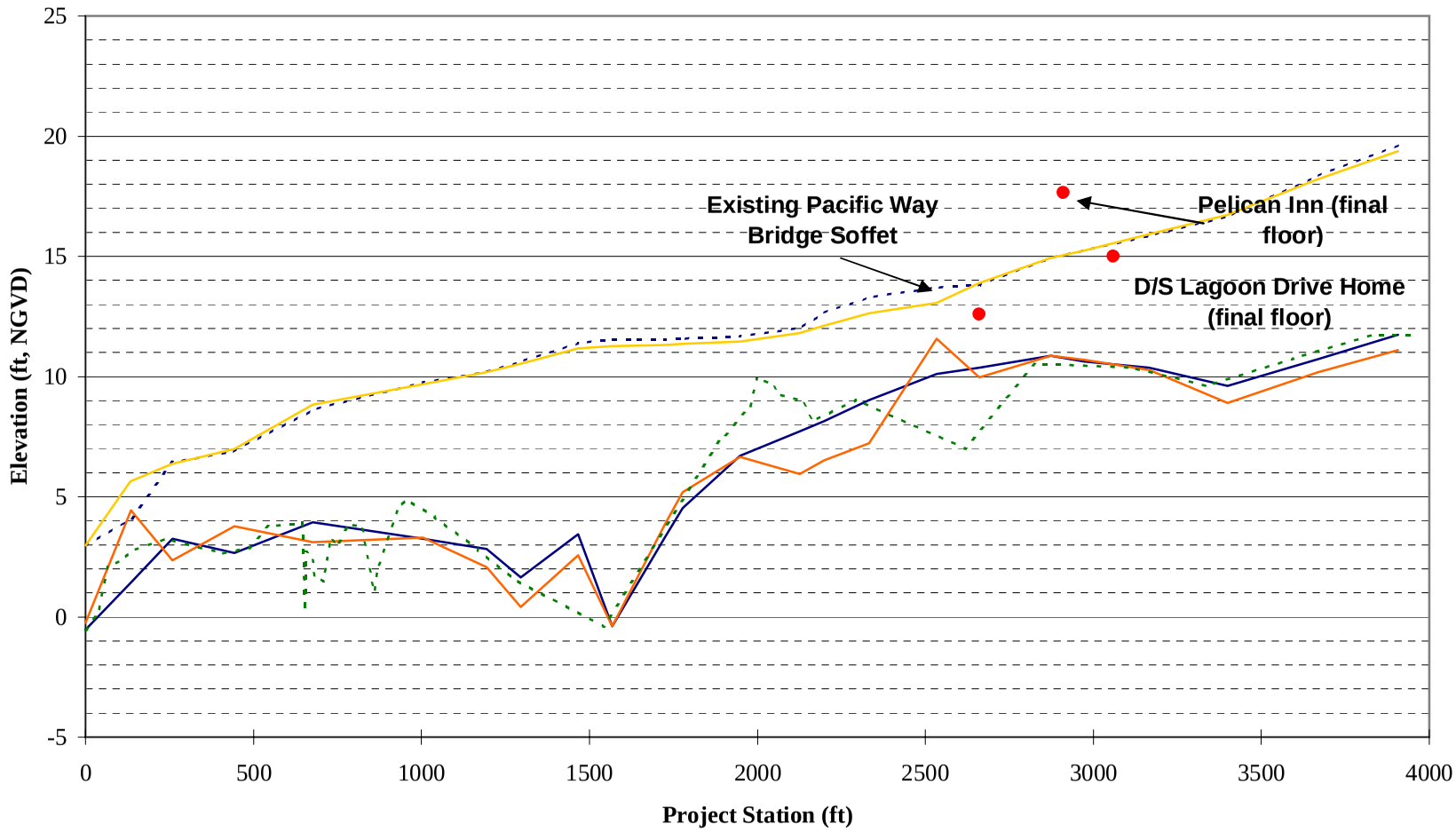
A1 Q6 A2 50' Q6 A2 150' Q6

figure 30

Maximum Flow Width Values for Sediment Transport Simulations

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. "Typical" sediment loading based on Water Year 2005 hydrograph from Dec 1st to January 10th (Qmax = 895 cfs) and Redwood Creek sediment data (Stillwater, 2004).

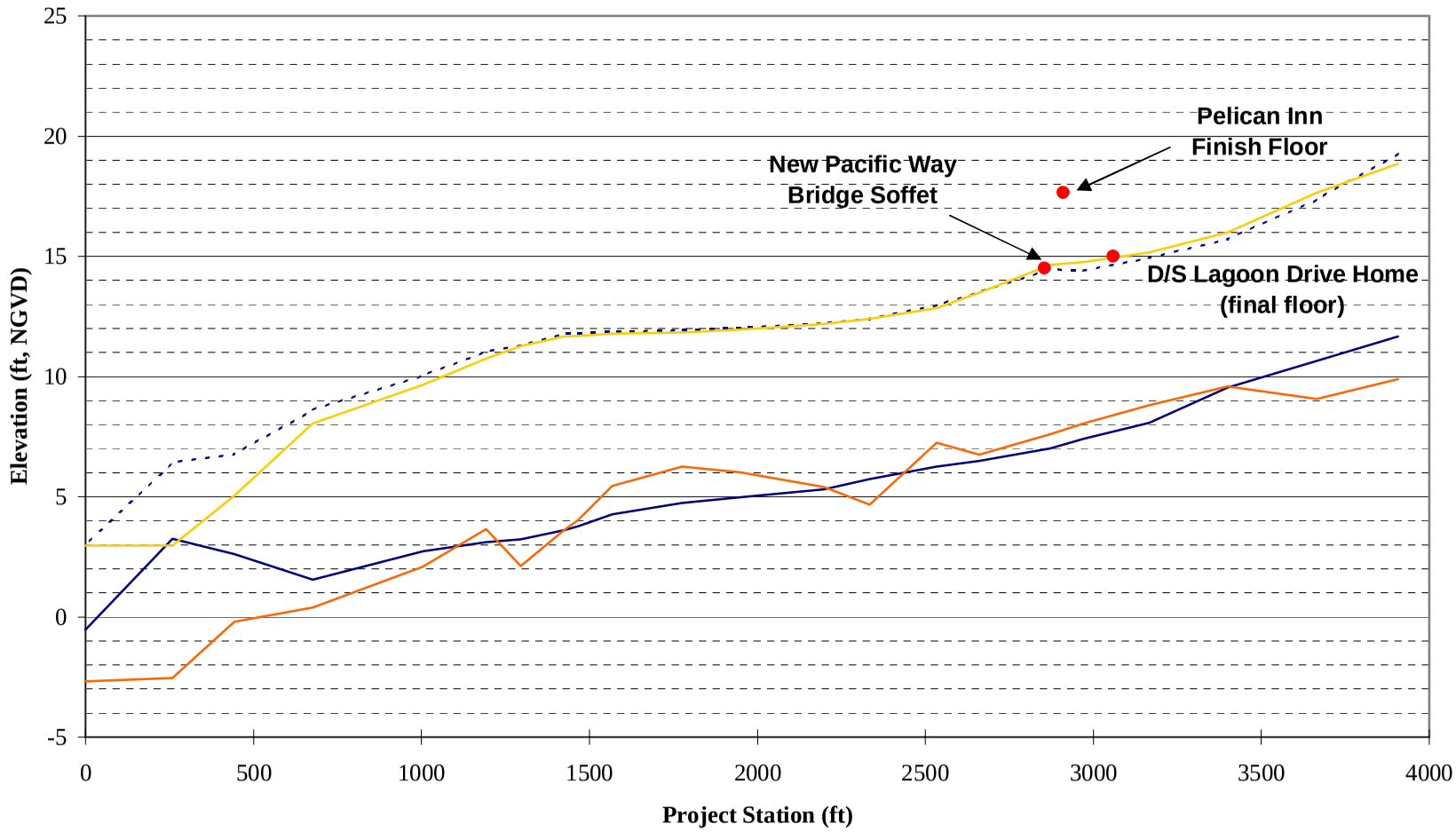
Initial Thalweg	Post-Simulation Thalweg
Post-Dredge (2003) Thalweg	Spot Elevations
Intial 5-Year Water Surface	Post-Sim 5-Year Water Surface

figure 31

Five Years of "Typical" Sediment Loading with 5-Year Flood Levels: Alternative 1- No Action

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. "Typical" sediment loading based on Water Year 2005 hydrograph from Dec 1st to January 18th (Qmax = 895 cfs) and Redwood Creek sediment data (Stillwater, 2004).

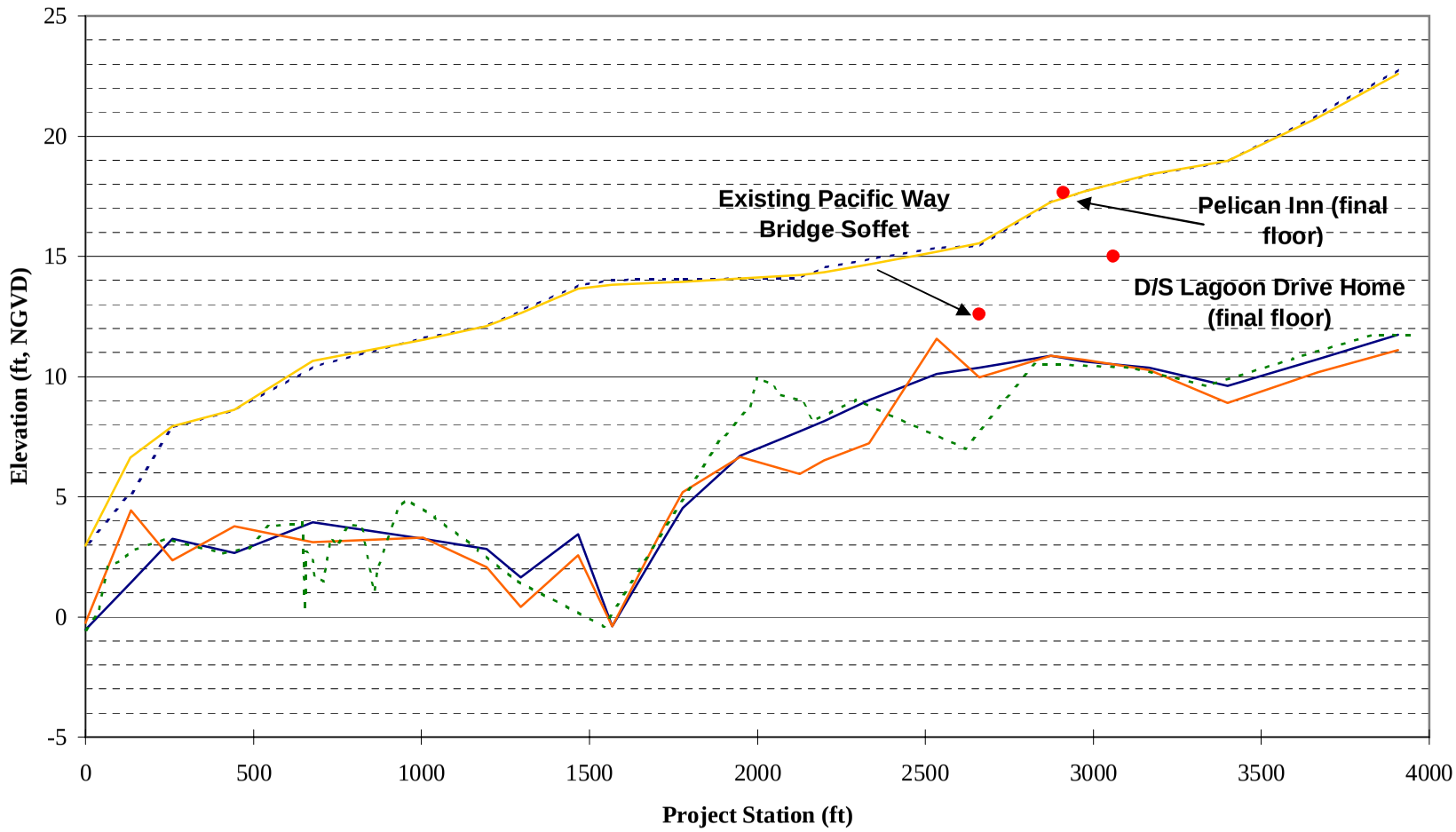
- Initial Thalweg
- Post-Simulation Thalweg
- Initial 5-Year Water Surface
- Post-Sim 5-Year Water Surface
- Spot Elevations

figure 32

Five Years of "Typical" Sediment Loading with 5-Year Flood Levels:
Alt 2- Creek Restoration and 150 foot Bridge

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. "Typical" sediment loading based on Water Year 2005 hydrograph from Dec 1st to January 18th (Qmax = 895 cfs) and Redwood Creek sediment data (Stillwater, 2004).

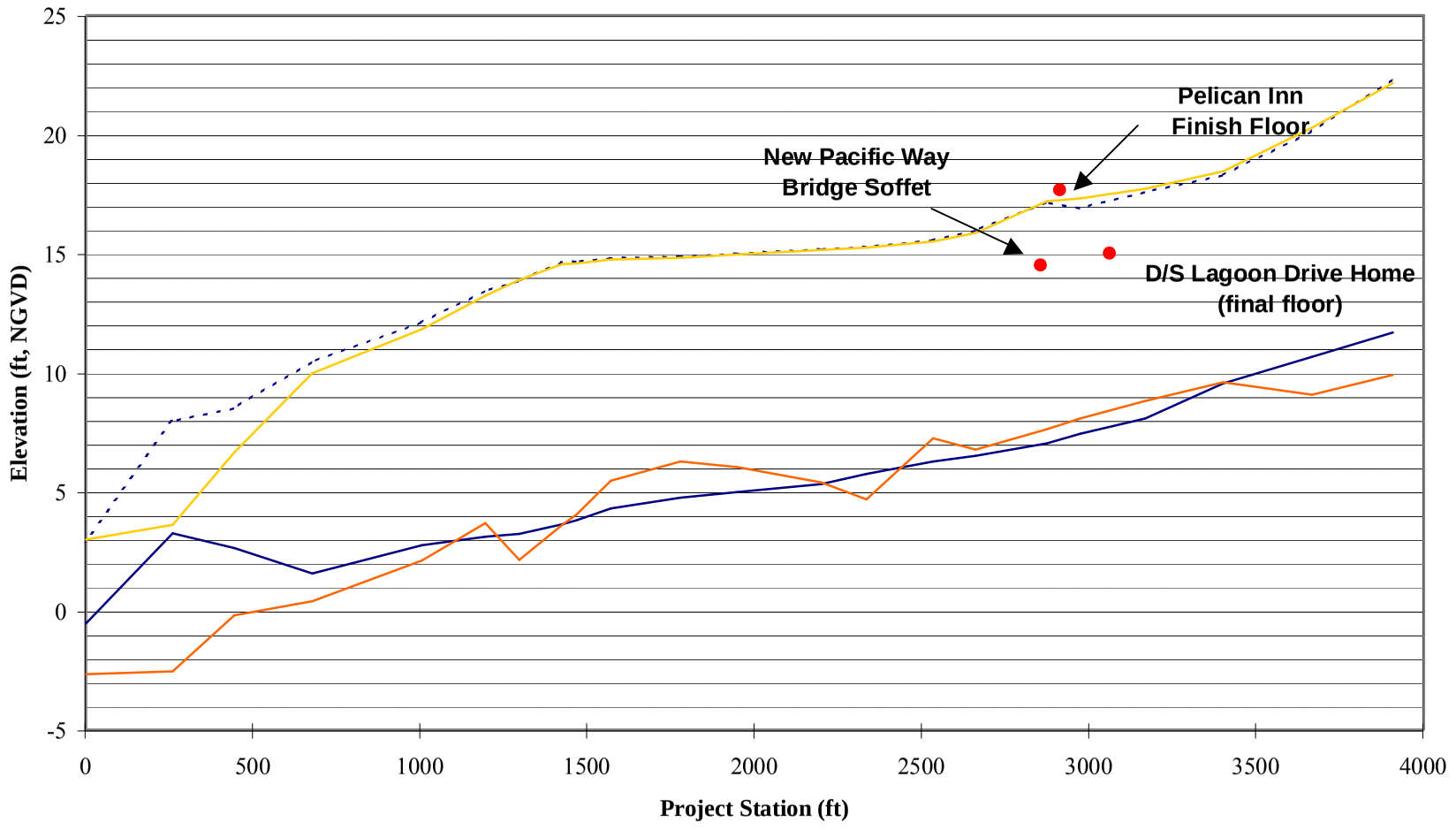
Initial Thalweg	Post-Simulation Thalweg
Post-Dredge (2003) Thalweg	Spot Elevations
Initial 100-Year Water Surface	Post-Sim 100-Year Water Surface

figure 33

Five Years of "Typical" Sediment Loading with 100-Year Flood Levels: Alternative 1- No Action

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. "Typical" sediment loading based on Water Year 2005 hydrograph from Dec 1st to January 18th (Qmax = 895 cfs) and Redwood Creek sediment data (Stillwater, 2004).

- Initial Thalweg
- Post-Simulation Thalweg
- Intial 100-Year Water Surface
- Post-Sim 100-Year Water Surface
- Spot Elevations

figure 34

Five Years of "Typical" Sediment Loading with 100-Year Flood Levels: Alt 2- Creek Restoration and 150 foot Bridge

PWA

PWA #: 1664.03

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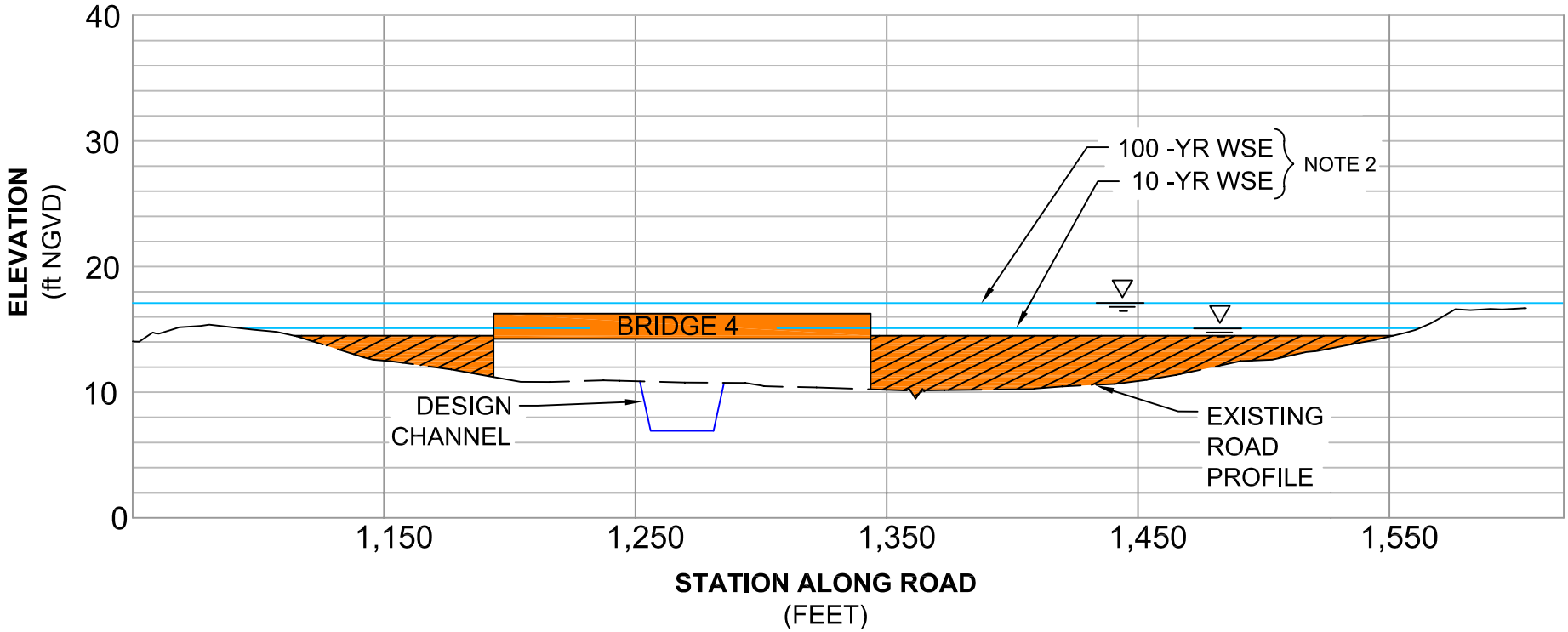

NOTES:

1. THIS IS A SCHEMATIC REPRESENTATION OF THE 150-FT SPAN BRIDGE (AS MODELED). THE ACTUAL DESIGN NEEDS TO INCLUDE TRANSITION FROM THE RAISED ROAD (EL. 14.5 FT) TO THE BRIDGE DECK (EL. 16.25 FT).

2. APPROXIMATE WATER SURFACE ELEVATION (WSE) ATTHE PELICAN INN UNDER EXISTING CONDITIONS.

figure **35**

150' Span Bridge (Option 4) for Scenario 3: Creek Restoration and New Bridge

PWA

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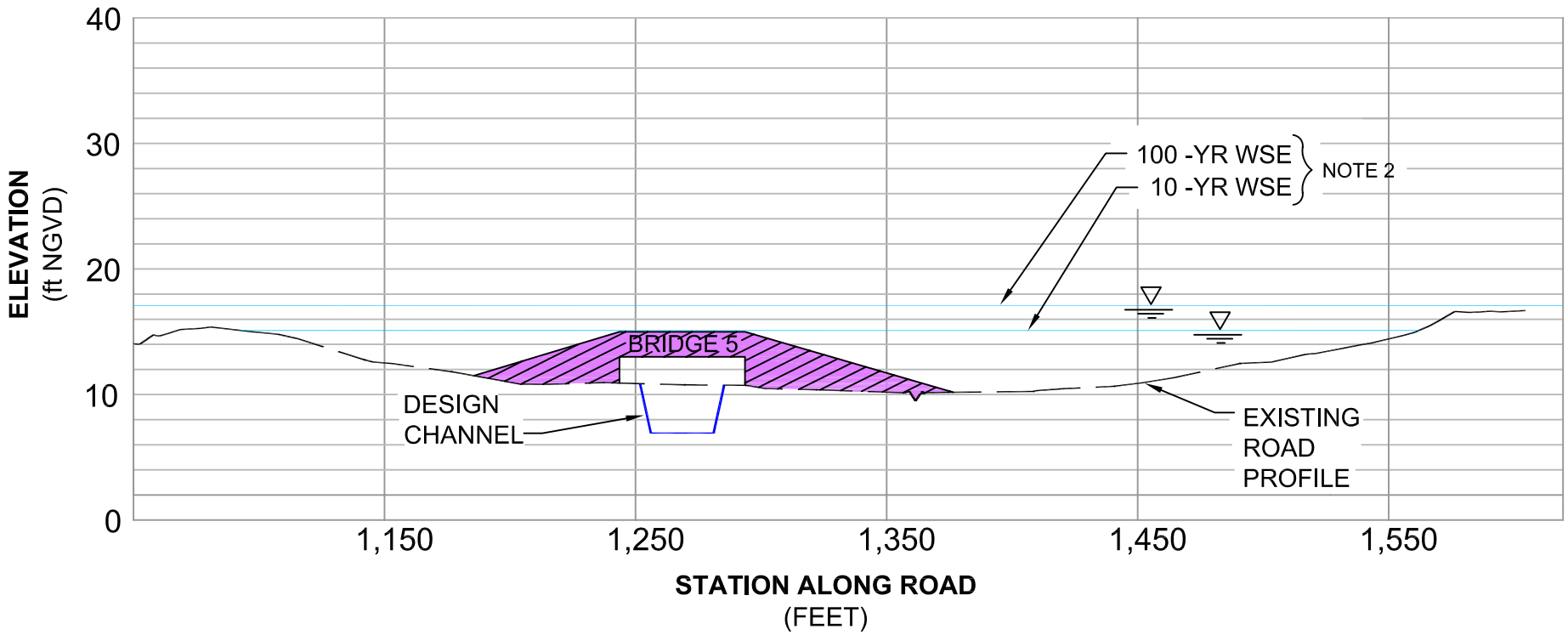


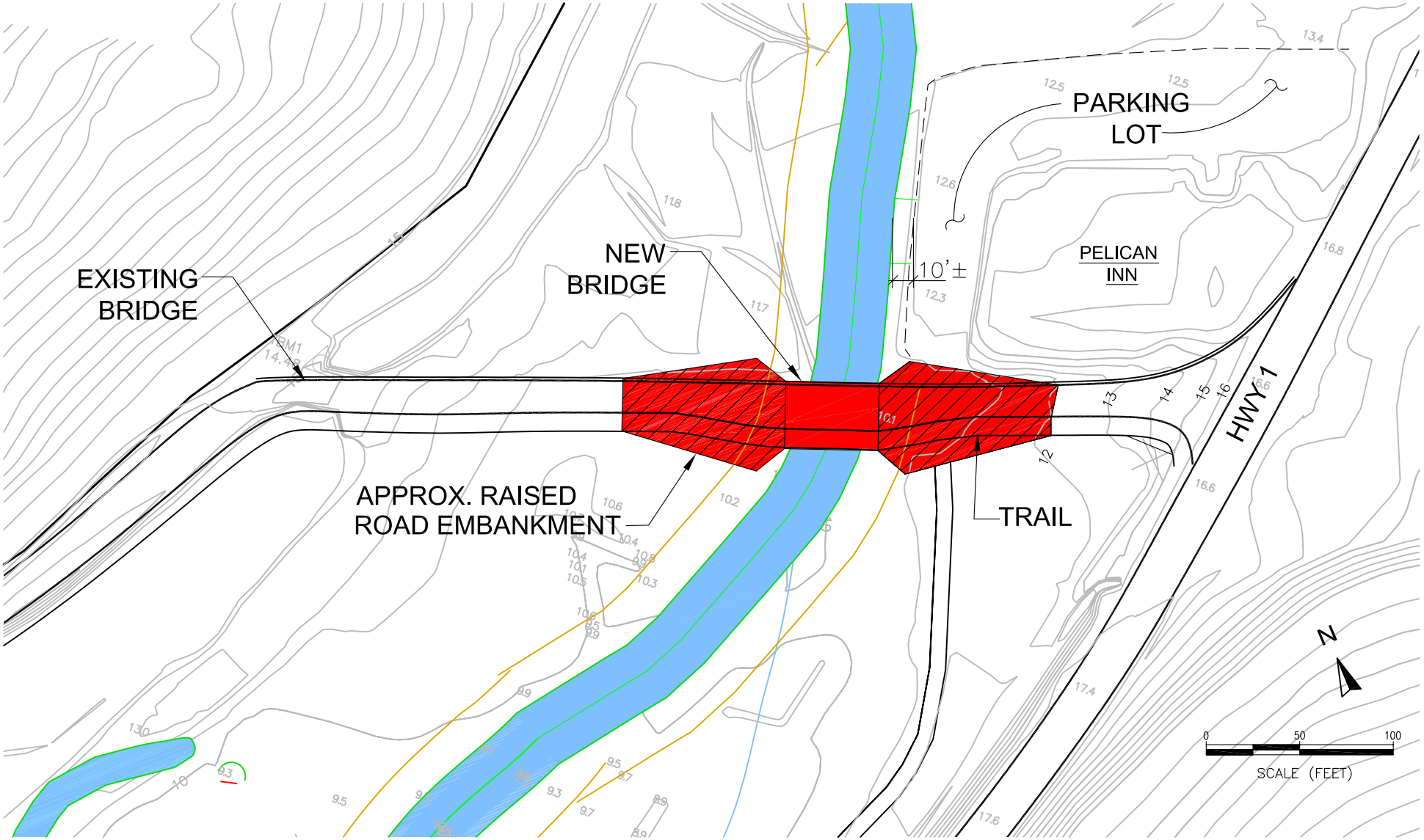
NOTES:
1. BRIDGE 5 IS A 50-FOOT SPAN BRIDGE WITH THE ROAD RAISED ONLY AS NEEDED TO TRANSITION TO BRIDGE DECK (EL. 15.0 FT).

2. APPROXIMATE WATER SURFACE ELEVATION (WSE) AT THE PELICAN INN UNDER EXISTING CONDITIONS.

figure **36**

50' Span Bridge (Option 5) for Scenario 3: Creek Restoration and New Bridge

PWA



NOTES:
1. HYPOTHETICAL SCENARIO WITH CREEK & 50' BRIDGE LOCATED AS CLOSE AS PRACTICAL TO THE PELICAN INN. (THIS CONFIGURATION WAS NOT MODELED) SEE FIGURE 38 FOR PROFILE.

figure 37

Schematic Plan for 50' Span Bridge Located near Pelican Inn

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PWA

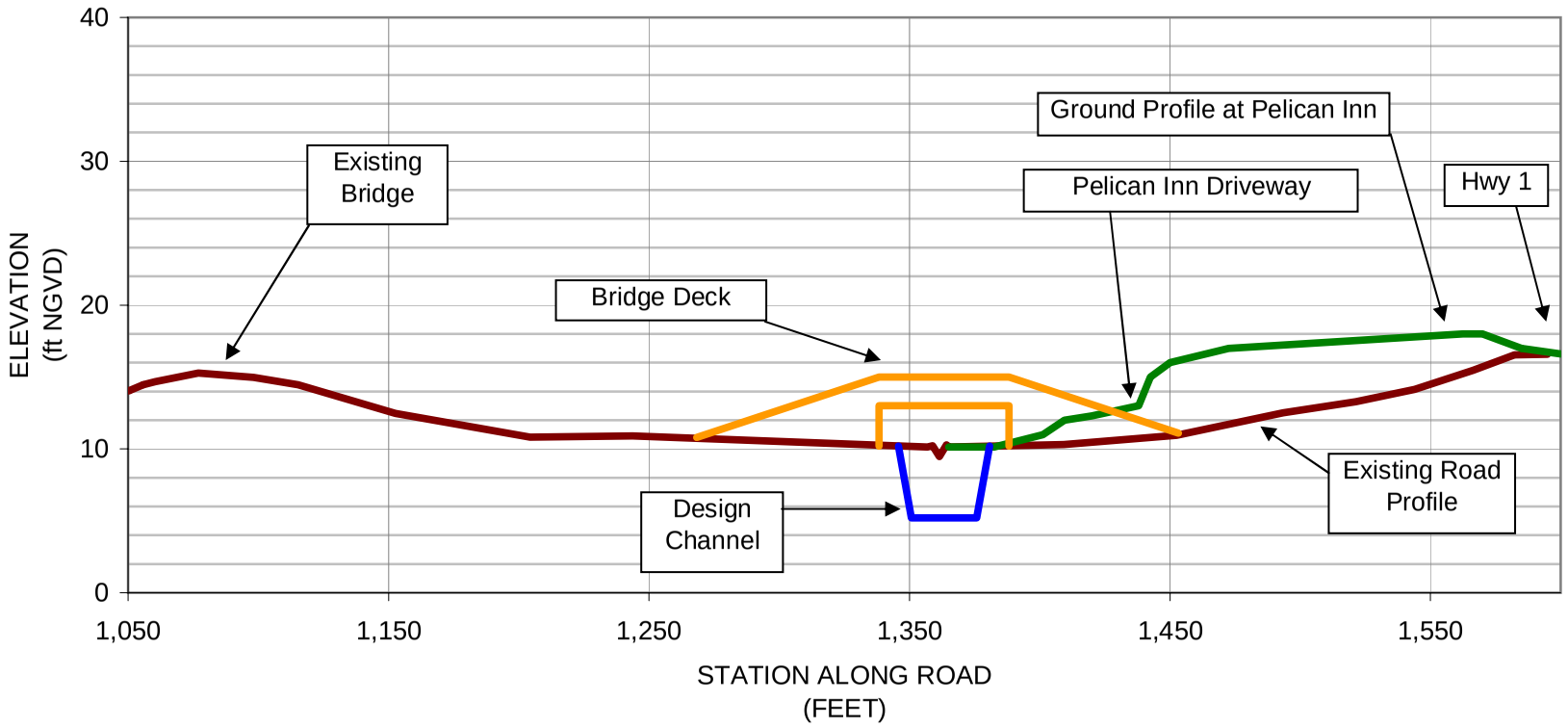
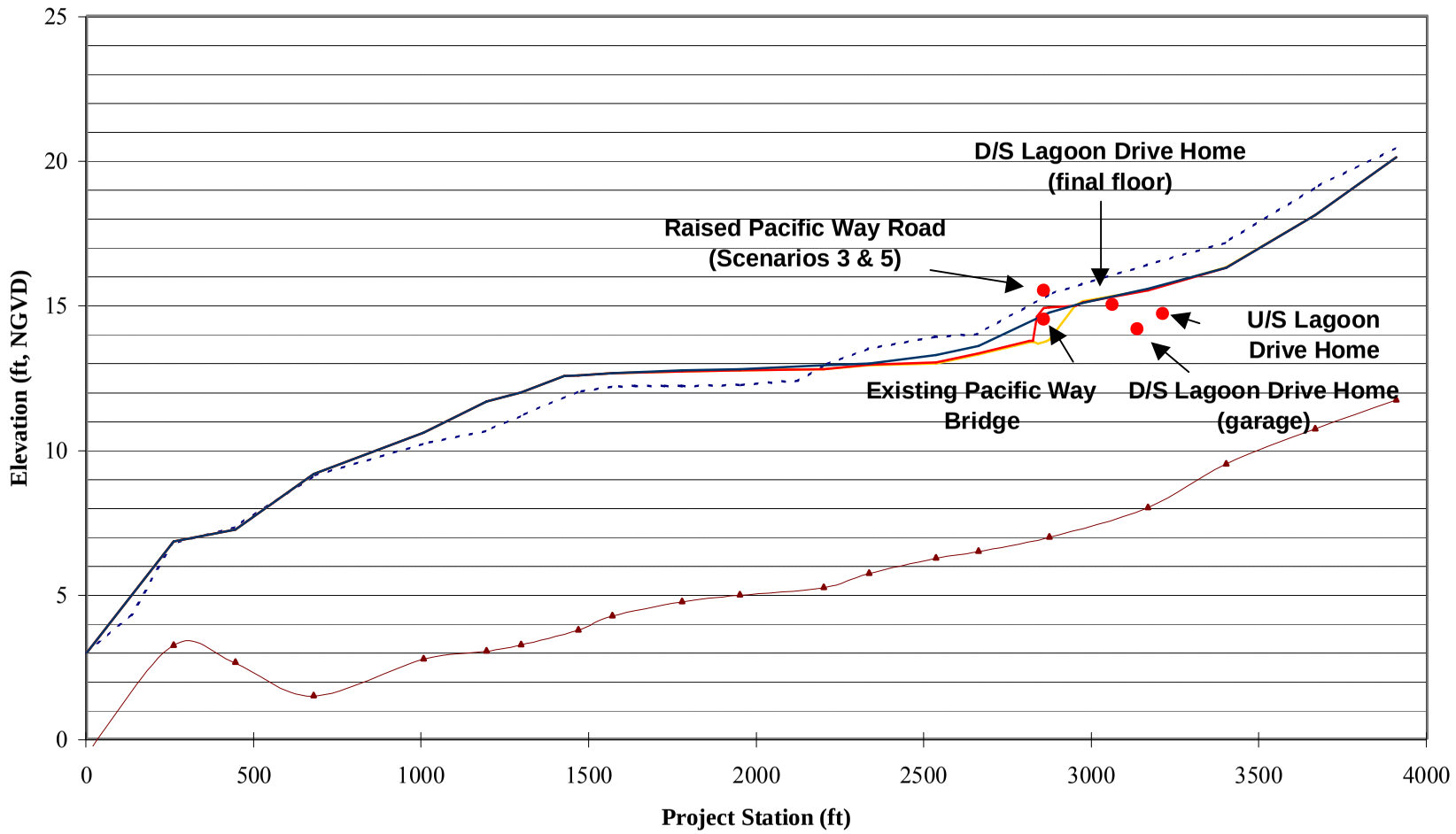


figure 38

NOTE: 1. HYPOTHETICAL SCENARIO WITH CREEK & BRIDGE LOCATED AS CLOSE AS PRACTICAL TO THE PELICAN INN (TO MINIMIZE THE FLOODPLAIN OBSTRUCTION CAUSED BY THE ROAD EMBANKMENT). SEE FIGURE 37 FOR PLAN VIEW.

Schematic Profle for Bridge 5 Located Near Pelican Inn

PWA



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. All cross sections are in the same locations for each alternative, however distances between cross sections may be different between each alternative.

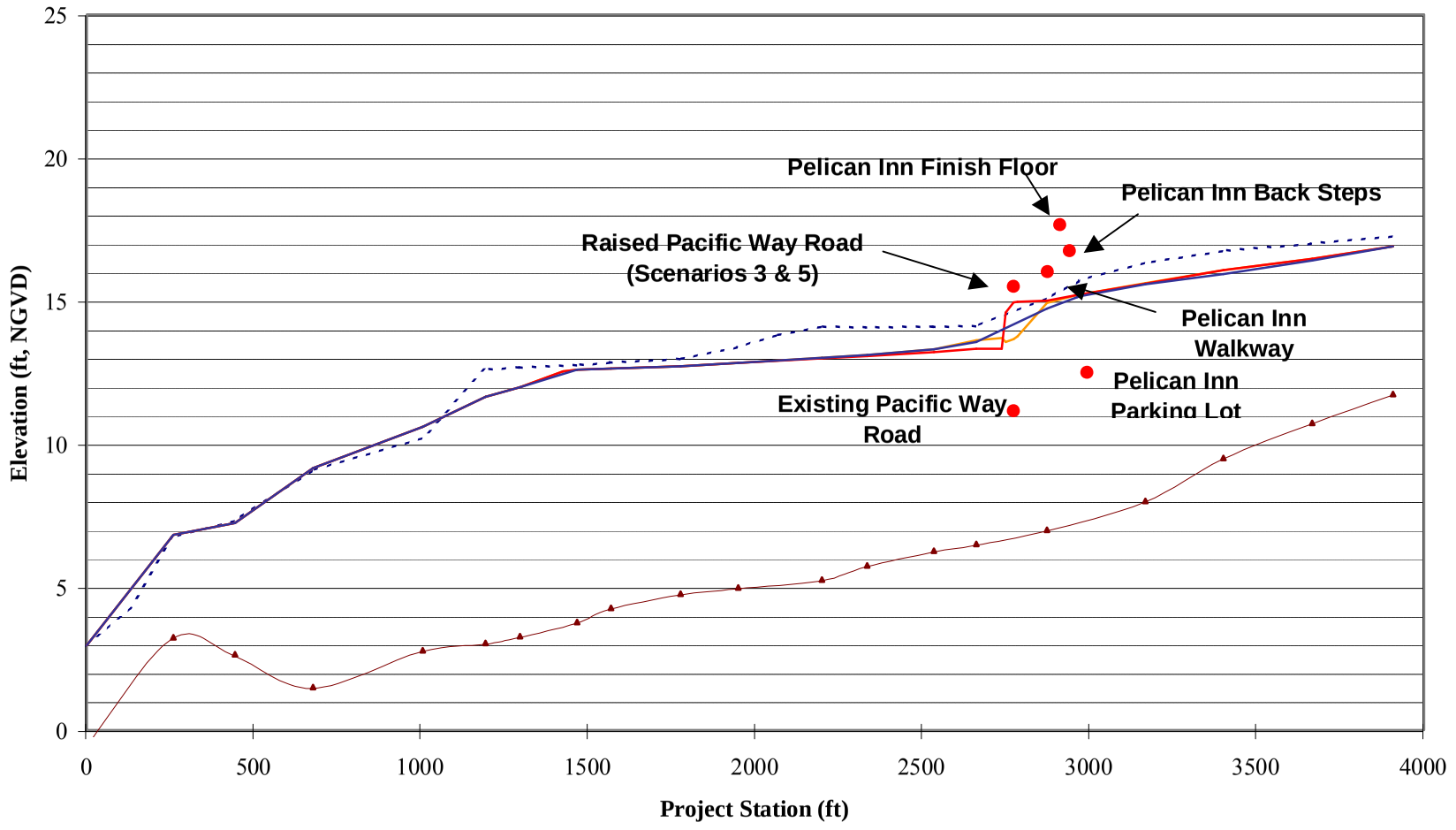
- No action, existing conditions
- 50-foot bridge, w/o raised road
- 150-foot bridge, w/ raised road
- 280-foot bridge
- Restored Creek Thalweg
- Spot Elevations

figure 39

Comparison of Water Levels on the Right Floodplain during the 10-Year Flow for Bridges 2, 4, and 5

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. All cross sections are in the same locations for each alternative, however distances between cross sections may be different between each alternative.

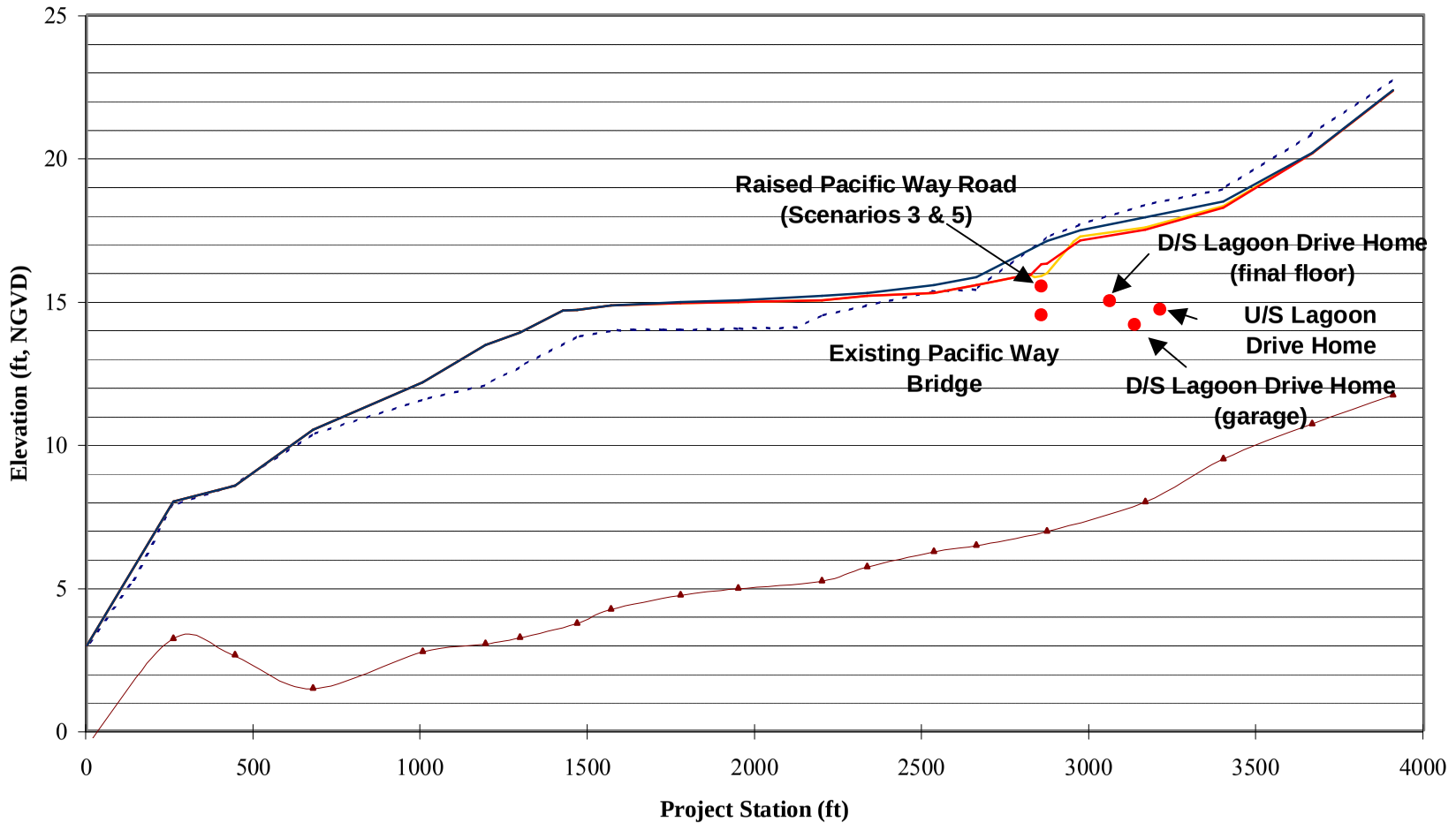
- No action, existing conditions
- 50-foot bridge, w/o raised road
- 150-foot bridge, w/ raised road
- 280-foot bridge
- Restored Creek Thalweg
- Spot Elevations

figure 40

Comparison of Water Levels on the Left Floodplain during the 10-Year Flow for Bridges 2, 4, and 5

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. All cross sections are in the same locations for each alternative, however distances between cross sections may be different between each alternative.

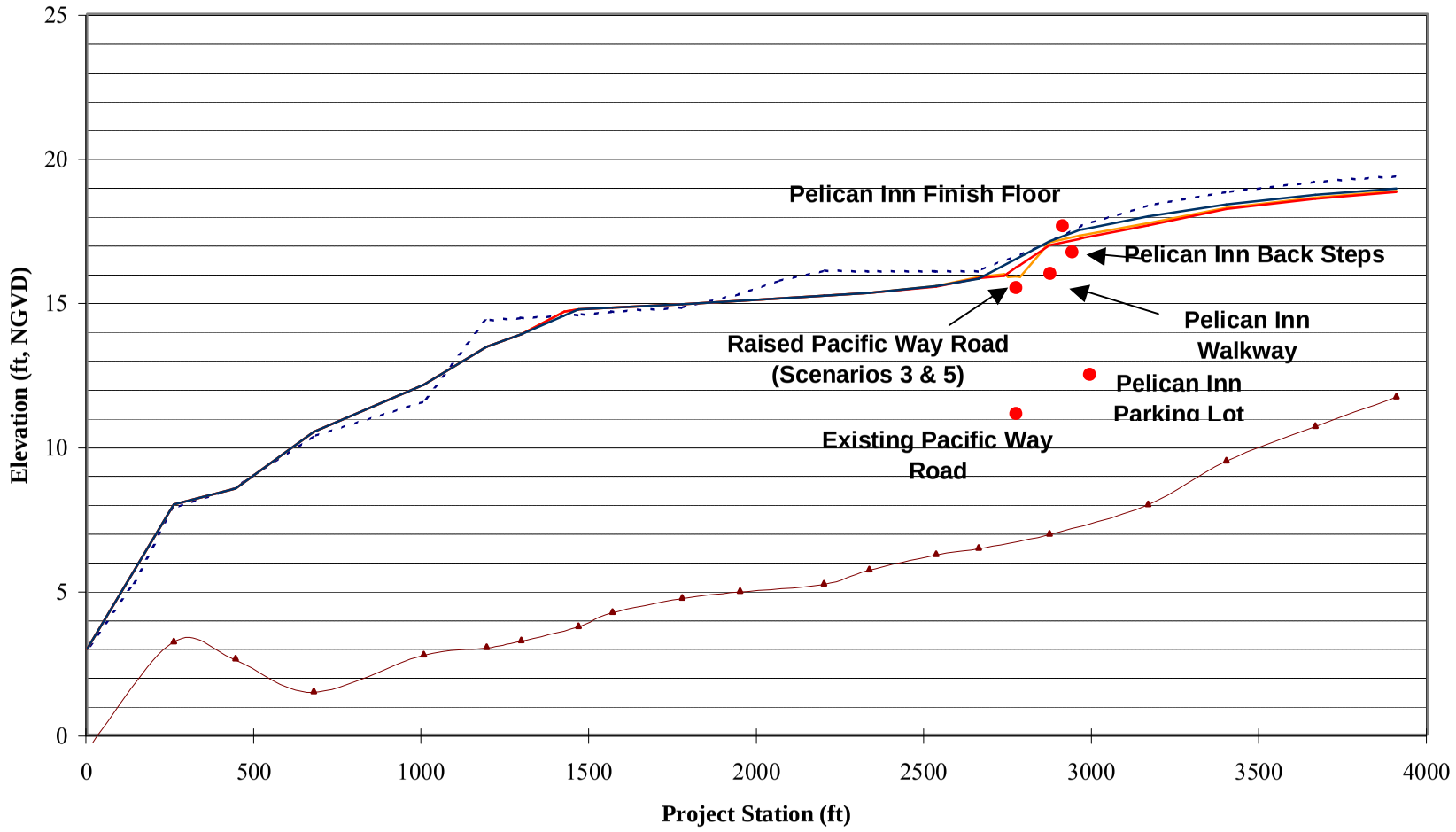
- No action, existing conditions
- 50-foot bridge, w/o raised road
- 150-foot bridge, w/ raised road
- 280-foot bridge
- Restored Creek Thalweg
- Spot Elevations

figure 41

Comparison of Water Levels on the Right Floodplain during the 100-Year Flow for Bridges 2, 4, and 5

PWA

PWA #: 1664.03



Notes: Alternative and spot elevation chainages based on Alternative 1 MIKE network. All cross sections are in the same locations for each alternative, however distances between cross sections may be different between each alternative.

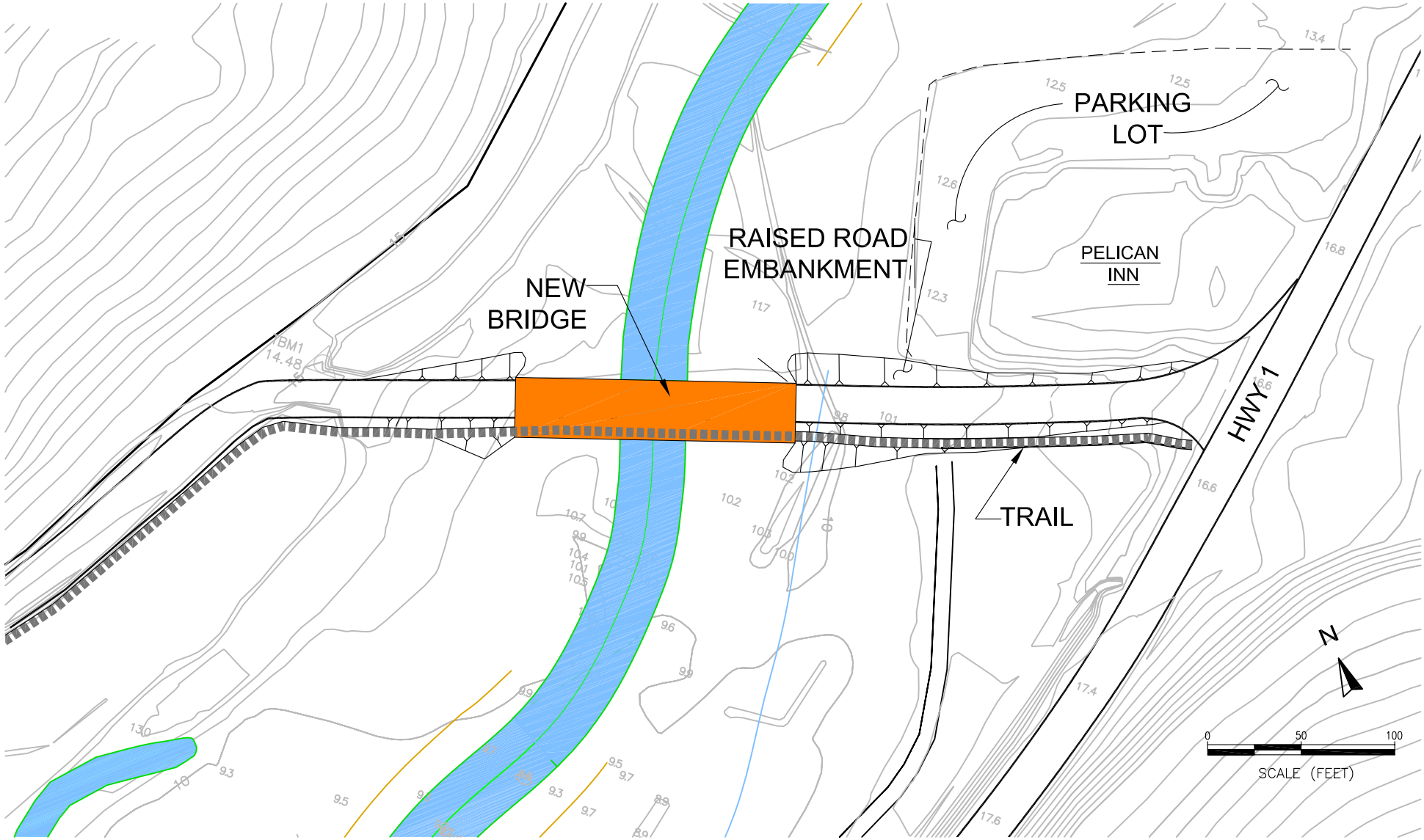
- No action, existing conditions
- 50-foot bridge, w/o raised road
- 150-foot bridge, w/ raised road
- 280-foot bridge
- Restored Creek Thalweg
- Spot Elevations

figure 42

Comparison of Water Levels on the Left Floodplain during the 100-Year Flow for Bridges 2, 4, and 5

PWA

PWA #: 1664.03

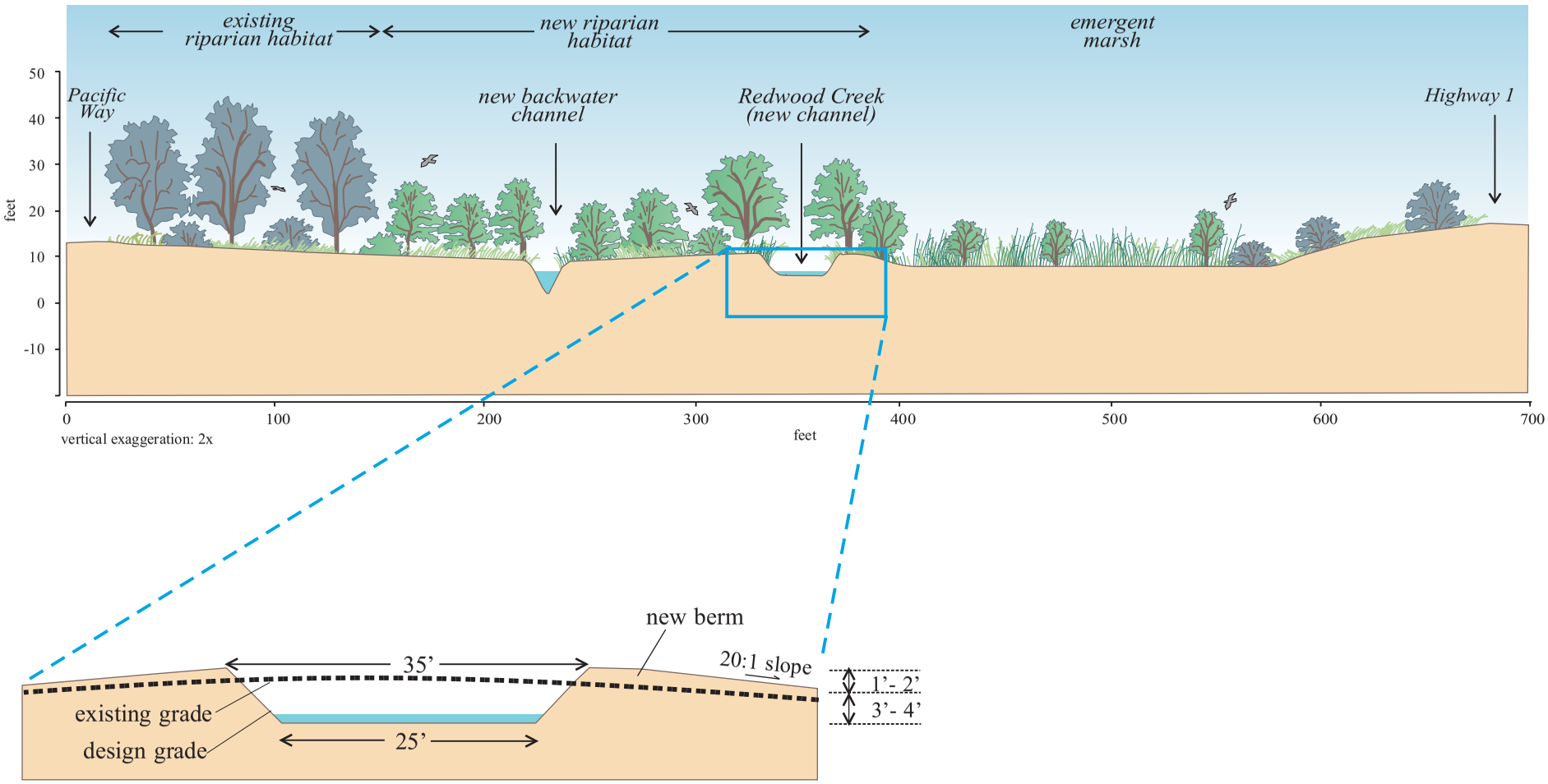


NOTES:
1. SCHEMATIC REPRESENTATION OF 150' SPAN BRIDGE WITH ROAD RAISED TO ELEVATION 14.5 OR GREATER.

figure **43**

Schematic Plan for 150' Span Bridge

Q:\Projects\1664.02_BIG_LAGOON_COST_EST\MODEL\060406_Bridge_Plan.dwg 4-10-06 12:21:57 PM e.wisnosky



1:1 scale
(no vertical exaggeration)

figure 44

CONCEPTUAL CROSS-SECTION

Alternative 2
Creek Restoration

PWA

Note:
See Figure 1 for approximate location of conceptual cross-section.

Appendix E

Phillip Williams & Associates Refined Modeling

Exhibit 2: Final Environmental Impact Statement

PWA
PHILIP WILLIAMS & ASSOCIATES
CONSULTANTS IN HYDROLOGY
720 CALIFORNIA ST., 6TH FLOOR, SAN FRANCISCO, CA 94108
TEL 415.262.2300 FAX 415.262.2303
SFO@PWA-LTD.COM

MEMORANDUM

DATE: March 11, 2005
TO: Michael Stevenson
COMPANY: JONES AND STOKES
FROM: Ann Borgonovo, Matt Wickland
COPY TO: Carolyn Shoulders
RE: Big Lagoon Wetland and Creek Restoration Project EIR/EIS Hydraulic Model
PWA Ref. #: 1769.03

Overview

The one–dimensional hydrodynamic modeling software MIKE 11 was used to model the various alternatives of the restoration project, including the no-action alternative. Each alternative's network is comprised of main branch, various overbank and floodplain flow paths, and linkages connecting the different paths and branches.

PWA updated cross sections and flow paths of the existing un-calibrated Big Lagoon MIKE 11 model with new survey data provided by the National Park Service (NPS) for the area around stations 1,750 to 2,150. This new data reflected the creek's current flow path closer to the road upstream of the parking lot. A new bridge modeling function available with the most updated version of MIKE 11 was utilized to better reflect Pacific Way Bridge under current conditions. Alternatives 2 and 4 were modeled with the proposed new bridge at Pacific Way. This soffit of the 200 foot long bridge was set at 16.5 ft NGVD. Additionally, PWA used a site visit and a 2003 color orthophoto to better specify the roughness values (Manning's n) for different reaches, branches, and floodplains of Redwood Creek. Low roughness areas include the recently-dredged portion of the channel and furthest downstream section near the beach. High roughness areas include the vegetated portions of the floodplain and the willow-choked zone near the parking lot.

The hydraulic model did not include flows from the two Green Gulch tributaries (Green Gulch Creek and the unnamed tributary). At present, the hydrology of Green Gulch Creek is not well defined. The limited information available on Green Gulch flows (PWA et al., 1994; PWA et al., 2003) suggests that Green Gulch flows are not significant relative to flows on Redwood Creek.

Alternative 1 Calibration

NPS provided PWA with measured flow rates and daily stage data at the Highway 1 Bridge and peak water surface elevations (WSE) at several points in the project site from storm events in December 2004 and January 2005. The measured flow rates at Highway 1 from water year 2005 were used to create a rating curve (R^2 = 0.986) for the current channel. This was then applied to the stage data in order to create several hydrographs that could be inputted into the model for calibration purposes. Peak water surface elevation data was available for several days in the winter of water year 2005 at three locations: upstream and downstream of Pacific Way Bridge and at the pedestrian bridge. To calibrate the model, roughness values were adjusted for different portions of the channel and floodplain. Table 1 compares the measured water surface elevations with those predicted by the calibrated model.

Table 1: Comparison of Measured Water Surface Elevations and those Predicted by the MIKE Model

	WSE at Station 2,875		WSE at Station 2,330		WSE at Station 1,190	
	Measured	Predicted	Measured	Predicted	Measured	Predicted
December 7	-	-	3.34	3.53	-	-
December 8	4.33	4.36	3.98	4.00	-	-
December 29	4.46	4.43	4.13	4.02	2.86	2.89
December 31	4.18	3.79	3.76	3.53	2.37	2.16
January 1	3.88	3.84	3.76	3.57	2.34	2.21

Alternatives 2 and 4 Calibration

For existing conditions, the roughness in the main channel ranged from 0.03 in sandy areas to 0.08 in areas with dense vegetation. The majority of the channel had n values around 0.045. For both Alternatives 2 and 4, the roughness in the main channel ranged from 0.03 in sandy areas to 0.09 in areas anticipated to have high concentrations of large woody debris. A typical n value that characterized the rest of the main channel after restoration was 0.06. Alternative 4 had a roughness value of 0.03 in the large lagoon, with n values of approximately 0.09 for the wetland vegetation surrounding the lagoon. The overbank and floodplain areas had Manning's n values of 0.10 and 0.12 depending on the relative amount of roughness and the expected flow depth.

Results

Time-series hydrographs for the 5-year, 50-year, and 100-year flood events were used as an upstream boundary for each model. The downstream boundary was set at a constant water level of mean higher high water (MHHW). The model was run for a period of 32 hours, which allowed enough time for the

peak flows to migrate through the entire reach. Peak water surface elevations were recorded at each cross section for each of the three flow regimes. These results are shown in Figures 1.1, 1.2, and 1.3. In addition, peak flood water surface elevations are shown in comparison with the channel thalweg used in the hydraulic model for each alternative in Figures 2.1, 2.2, and 2.3.

Exhibit 2: Final Environmental Impact Statement

figure **A-1**

Big Lagoon Wetland and Creek Restoration Project EIR/EIS

Alternative 1: MIKE 11 Network

PWA #: 1769.03

PWA

Exhibit 2: Final Environmental Impact Statement

Appendix F

DKS Associates Traffic Memorandum

Exhibit 2: Final Environmental Impact Statement

DKS Associates
TRANSPORTATION SOLUTIONS

MEMORANDUM

TO: Michael Stevenson, Jones & Stokes

FROM: Mark Spencer and Patty Camacho

DATE: June 21, 2006

SUBJECT: Muir Beach EIR – Traffic LOS Analysis & Parking Analysis P/A No. 05005-000

This memo provides supplemental analysis to the April 04, 2005 submittal by DKS Associates to include changes in the traffic and parking circulation. DKS Associates has reviewed supplemental traffic and parking data collected by Robert Peccia & Associates during the summer of 2004. The most recent data were used for comparison to the 2001 and 2002 data used in the Existing Conditions Technical Memorandum for the Comprehensive Transportation Management Plan (CTMP), which was the basis for the preliminary traffic analysis for the Muir Beach EIR prepared by DKS Associates.

2004 Traffic and Parking Data

Data collected during the summer of 2004 is representative of the peak season and was reviewed to establish the accuracy and validate the 2001 and 2002 conditions during both the peak season. The data collected consisted of hourly roadway traffic volumes from mid-June to mid-September at 14 locations within the CTMP area and parking surveys at four areas with the Marin Parklands including Muir Beach.

When compared to data collected in 2001 and 2002, on average, data collected in July 2004 was found to be less than the 2001 peak season, during the weekday and weekend periods. The traffic analysis considers the traffic conditions of the Peak, Shoulder and Off-Peak Seasons during the weekday and weekend peak hours. In addition, the traffic analysis also considers the effect of the parking alternatives considered under the various restoration alternatives.

Revised Traffic LOS Analysis & Parking Analysis

Based on the 2004 traffic and parking data results, it was found that the traffic LOS and parking analysis previously prepared provide a conservative estimate of the potential impacts under each scenario analyzed.

Intersection level of service was performed for the weekday and weekend peak hours at the following intersections:

1. Shoreline Highway & Muir Woods Road
2. Shoreline Highway & Pacific Way
3. Shoreline Highway & Panoramic Highway (three corners)

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Average Daily Traffic (ADT)[1] volumes for the weekday and weekend conditions were provided (bi-directional) for the Peak, Shoulder and Off-Peak Seasons for the following roadway segments:

1. Panoramic Highway at Shoreline Highway "Three Corners"
2. Shoreline Highway south of Panoramic Highway
3. Shoreline Highway between Panoramic Highway and Muir Woods Road (Frank Valley Road)
4. Muir Woods Road (Frank Valley Road) near Shoreline Highway
5. Shoreline Highway north of Muir Woods Road (Frank Valley Road)

Peak Hour[2] volumes for the weekday condition were also provided (by direction) for the Peak and Shoulder Seasons only for the roadway segments mentioned above. Intersection turning movement counts were also made available for the Peak Season[3] for the intersections of Shoreline Highway & Muir Woods Road and Shoreline Highway & Panoramic Highway.

I. Study Methodology

Existing Conditions – Weekday Peak

Since weekday peak hour volumes were only available for the Peak and Shoulder season, the Off-Peak season volumes were calculated based on the average percent differential between the Peak and Shoulder season roadway volumes (by direction). The percent for the Peak and Shoulder season was determined based on the peak hour roadway differential volumes (given) divided by the Average Daily Traffic Volumes of the same roadway segment.

In order to evaluate existing weekday peak conditions for the Peak, Shoulder and Off-Peak Seasons, a turning movement percent, by approach, was determined for the intersections of Shoreline Highway & Muir Woods Road and Shoreline Highway & Panoramic Highway (three corners) using the weekday midday intersection turning movement counts. Using the weekday peak hour roadway volumes, the turning movement percent was then applied to each approach to determine the overall turning movement volumes. This same methodology was applied to the Shoulder and Off-Peak Season conditions.

Since no data were available for the intersection of Shoreline Highway and Pacific Way, DKS recently performed weekday midday and p.m. peak counts during the off-peak season. In order to evaluate the weekday peak hour condition for this intersection, a seasonal average percent increase was calculated for the adjacent intersections and applied to this intersection. The average percent increase was based on the overall weekday peak hour intersection total volumes from season to season periods.

[1] CTMP. Robert Peccia & Associates Existing Conditions Technical Memorandum. Chapter 4, Figure 4.1 and 4.2.
[2] CTMP. Robert Peccia & Associates. Existing Conditions Technical Memorandum. Chapter 4, Figure 4.3 and 4.4.
[3] Robert Peccia & Associates.

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Table 1 shows the intersection level of service for the weekday peak hour conditions.

Table 1

Intersection Level of Service Summary - Weekday Peak Hour

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	16.5	C	13.1	B	12.4	B
2.	Shoreline Highway & Pacific Way	14.8	B	11.5	B	11.0	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	28.9	D

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Existing Conditions – Weekend Peak

Weekend peak hour volumes were determined using the same percent differential of the weekday peak volumes to the weekday ADT and applying it to the ADT of the weekend condition to derive peak hour volumes for each of the roadway segments in the study area. This was done for the Peak, Shoulder and Off-Peak seasons.

In order to evaluate existing weekend peak conditions for the Peak, Shoulder and Off-Peak Seasons, a turning movement percent, by approach, was determined for the intersections of Shoreline Highway & Muir Woods Road and Shoreline Highway & Panoramic Highway (three corners) using the weekend midday intersection turning movement counts. Using the weekend peak hour roadway volumes the turning movement percent was then applied to each approach to determine the overall turning movement volumes. This same methodology was applied to the Shoulder and Off-Peak Season conditions.

Since no data were available for the intersection of Shoreline Highway and Pacific Way, DKS calculated the percent increase from weekday to weekend intersection volumes of the adjacent street and applied it to the weekday volumes at Shoreline Highway and Pacific Way. In order to evaluate the weekend peak hour condition for this intersection, an average percent increase was calculated for the adjacent intersections and applied to this intersection. The average percent increase was based on the overall weekend peak hour intersection total volumes of the adjacent street from season to season periods.

Table 2 shows the intersection level of service for the weekend peak hour conditions.

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Table 2

Intersection Level of Service Summary – Weekend Peak Hour

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	>50	F	>50	F	24.3	C
2.	Shoreline Highway & Pacific Way	17.9	C	15.2	C	11.3	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	>50	F

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

II. Public Access Alternatives

This section provides the context by which changes in the traffic circulation and parking supply for the various restoration alternatives will be measured for the traffic analysis.

Table 3 shows the existing parking demand for the weekday and weekend during the Peak, Shoulder and Off-Peak seasons. The parking demand is based on a supply of 175 spaces. **Table 4** shows a comparison between the alternatives and the parking surplus/shortage for the weekday and weekend conditions during the Peak, Shoulder and Off-Peak Seasons. Parking demand surplus/shortage is based on the existing demand (**Table 3**).

Table 3
Parking Demand for Weekday and Weekend

Day of Week	Peak[1]		Shoulder[2]		Off-Peak[2]	
	%	# of Veh	%	# of Veh	%	# of Veh
Weekday	91	159	66	115	17	30
Weekend	115	201	91	160	69	120

[1] CTMP. Robert Peccia & Associates Existing Conditions Technical Memorandum. Chapter 5.
[2] CTMP Parking Information. Working Draft. August 29, 2003

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Table 4
Parking Demand Analysis – Weekday and Weekend
Surplus/Shortfall

Alternative	# of Spaces	Peak		Shoulder		Off-Peak	
		Weekday (159)	Weekend (201)	Weekday (115)	Weekend (160)	Weekday (30)	Weekend (120)
B-1	50	-109	-151	-65	-110	20	-70
B-2	145	-14	-56	30	-15	115	25
B-3	175	16	-26	60	15	145	55
B-4	175	16	-26	60	15	145	55
B-5	200	41	-1	85	40	170	80
C	118	-41	-83	3	-42	88	-2

(#) Estimated parking demand based on existing conditions, see Table 3.
Parking Shortfall

Alternative B-1

In order to evaluate the change in traffic conditions associated with Alternative B-1, it was assumed that 25% of the vehicles would remain in the parking lot while 75% of the vehicles would exit and travel to an alternate site. For example, during the Peak Season, Weekday peak period, 109 vehicles would be unable to find parking in the lot. Of these, approximately 27 would remain in the parking lot and wait for an open spot while 82 of the vehicles would circulate out of the lot and travel back via Pacific Way and Shoreline Highway

This assumption was applied for all scenarios (weekday and weekend) during the peak season in which there was a parking shortage.

Excess vehicles were re-routed at the intersection of Shoreline Highway and Pacific Way, assuming a 75% northbound and 25% southbound split at Shoreline Highway. This distribution is based on existing travel patterns and the locations of complementary land uses. The number of vehicles traveling northbound and/or southbound were then split assuming a 50-50 percent split at the intersection of Shoreline Highway and Muir Woods and Shoreline Highway and Panoramic Highway. For example, out of the 82 vehicles leaving the parking lot (under Alt. B1), 62 would travel north towards Muir Woods Road and 20 vehicles towards Panoramic Highway. Once these vehicles reach the other intersections the 50-50 split was assumed. At Muir Woods Road, approximately 31 vehicles would travel eastbound on Muir Woods Road, while the remaining 31 would continue traveling northbound on Shoreline Highway towards Stinson Beach.

Tables 5-9 show the level of service at the study intersections under all studied alternatives.

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Table 5A - Weekday
Intersection Level of Service Summary – Alternative B1

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	21.3	C	13.1	B	12.4	B
2.	Shoreline Highway & Pacific Way	15.3	C	11.5	B	11.0	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	28.9	D

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Table 5B - Weekend
Intersection Level of Service Summary – Alternative B1

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	>50	F	>50	F	26.5	D
2.	Shoreline Highway & Pacific Way	29.9	D	17.9	C	12.7	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	>50	F

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

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Alternative B-2

Table 6A – Weekday
Intersection Level of Service Summary – Alternative B2

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	19.9	C	13.1	B	12.4	B
2.	Shoreline Highway & Pacific Way	13.1	B	11.5	B	11.0	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	28.9	D

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Table 6B
Intersection Level of Service Summary – Alternative B2

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	>50	F	>50	F	24.6	C
2.	Shoreline Highway & Pacific Way	21.3	C	15.2	C	11.5	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	>50	F

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

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Alternative B-3

Table 7A - Weekday
Intersection Level of Service Summary – Alternative B3

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	16.5	C	13.1	B	12.4	B
2.	Shoreline Highway & Pacific Way	14.8	B	11.5	B	11.0	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	28.9	D

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Table 7B - Weekend
Intersection Level of Service Summary – Alternative B3

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	>50	F	>50	F	24.3	C
2.	Shoreline Highway & Pacific Way	19.4	C	15.2	C	11.3	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	>50	F

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

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Alternative B-4

Table 8A – Weekday
Intersection Level of Service Summary – Alternative B4

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	16.5	C	13.1	B	12.4	B
2.	Shoreline Highway & Pacific Way	14.8	B	11.5	B	11.0	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	28.9	D

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Table 8B - Weekend
Intersection Level of Service Summary – Alternative B4

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	>50	F	>50	F	24.3	C
2.	Shoreline Highway & Pacific Way	19.4	C	15.2	C	11.3	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	>50	F

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Alternative B-5

This alternative would result in similar intersection operation as the existing condition. The parking lot operation during the peak season would improve as a result of the additional spaces, but the number of vehicles at the study intersections during peak periods would remain the same.

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Alternative C

Under Alternative C, a new parking lot would be constructed at Alder Grove located along Shoreline Highway (Highway 1), north of Pacific Way. It in anticipated that vehicles entering and existing this site would only affect the operation of Shoreline Highway & Muir Woods Road. The operation of the two other study intersection is not anticipated to differ under this scenario. **Table 9** shows the intersection level of service for this alternative.

Table 9
Intersection Level of Service Summary – Alternative C

#	Intersection	Weekday				Weekend			
		Peak		Peak		Shoulder		Off-Peak	
		Appr. Delay	LOS	Appr. Delay	LOS	Appr. Delay	LOS	Appr. Delay	LOS
1.	Shoreline Highway & Muir Woods Road	20.5	C	>50	F	>50	F	25.4	D

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Table 10 and Table 11 provide a summary comparison of the intersection level of service for each alternative during the weekday and weekend conditions.

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Table 10 – Weekday
Intersection Level of Service Comparison Summary

#	Alternative	Parking Spaces	Peak Appr. Delay	Peak LOS	Shoulder Appr. Delay	Shoulder LOS	Off-Peak Appr. Delay	Off-Peak LOS
Shoreline Hwy & Muir Woods Rd	Existing	175	16.5	C	13.1	B	12.4	B
	B1	50	21.3	C	13.1	B	12.4	B
	B2	145	19.9	C	13.1	B	12.4	B
	B3	175	16.5	C	13.1	B	12.4	B
	B4	175	16.5	C	13.1	B	12.4	B
	C	118	20.5	C	-	-	-	-
Shoreline Hwy & Pacific Wy	Existing	175	14.8	B	11.5	B	11.0	B
	B1	50	15.3	C	11.5	B	11.0	B
	B2	145	13.1	B	11.5	B	11.0	B
	B3	175	14.8	B	11.5	B	11.0	B
	B4	175	14.8	B	11.5	B	11.0	B
	C	118	-	-	-	-	-	-
Shoreline Hwy & Panoramic Hwy	Existing	175	>50	F	>50	F	28.9	D
	B1	50	>50	F	>50	F	28.9	D
	B2	145	>50	F	>50	F	>50	F
	B3	175	>50	F	>50	F	28.9	D
	B4	175	>50	F	>50	F	28.9	D
	C	118	-	-	-	-	-	-

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

DKS Associates
TRANSPORTATION SOLUTIONS

Table 11 – Weekend
Intersection Level of Service Comparison Summary

#	Alternative	Parking Spaces	Peak Appr. Delay	Peak LOS	Shoulder Appr. Delay	Shoulder LOS	Off-Peak Appr. Delay	Off-Peak LOS
Shoreline Hwy & Muir Woods Rd	Existing	175	>50	F	>50	F	24.3	C
	B1	50	>50	F	>50	F	26.5	D
	B2	145	>50	F	>50	F	24.6	D
	B3	175	>50	F	>50	F	24.3	D
	B4	175	>50	F	>50	F	24.3	D
	C	118	>50	F	>50	F	25.4	D
Shoreline Hwy & Pacific Wy	Existing	175	17.9	C	15.2	C	11.3	B
	B1	50	29.9	D	17.9	C	12.7	B
	B2	145	21.3	C	15.2	C	11.5	B
	B3	175	19.4	C	15.2	C	11.3	B
	B4	175	19.4	C	15.2	C	11.3	B
	C	118	-	-	-	-	-	-
Shoreline Hwy & Panoramic Hwy	Existing	175	>50	F	>50	F	>50	F
	B1	50	>50	F	>50	F	>50	F
	B2	145	>50	F	>50	F	>50	F
	B3	175	>50	F	>50	F	>50	F
	B4	175	>50	F	>50	F	>50	F
	C	118	-	-	-	-	-	-

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

DKS Associates
TRANSPORTATION SOLUTIONS

III. Parking Analysis

This section evaluates the potential parking queue for the restoration alternatives listed in **Table 4** for Peak, Shoulder and Off-Peak conditions. Based on parking utilization surveys conducted at the Muir Beach parking lot during the peak and shoulder seasons, a maximum hourly arrival rate (in vehicles) was calculated for each season except for the off-season. The maximum parking demand estimated for the off-peak season during a weekday and weekend period was assumed to be the same as the maximum arrival rate. **Table 12** lists the maximum hourly arrival rate (in vehicles), as well as the calculated vehicles per minute rate and the potential maximum number of vehicles queued at the parking lot entry point during the Peak, Shoulder and Off-Peak conditions for weekday and weekend periods.

Table 12

Queuing Analysis

Peak	Intersection	Peak[1]	Shoulder[1]	Off-Peak[2]
Weekday	Maximum Arrival Rate (vehicles)	103	103	30
	Vehicles per minute[3]	1.72	1.72	0.50
	Maximum # of Vehicles Queue[4]	26	26	8
Weekend	Maximum Arrival Rate (vehicles)	122	88	124
	Vehicles per minute	2.03	1.47	2.07
	Maximum # of Vehicles Queue	31	22	31

[1] Robert Peccia & Associates – Parking Demand Summary (Table 5-2 and Table 5-3).
[2] No arrival rate was available for the off-season. Maximum arrival rate assumed to be max parking demand (Table 3).
[3] Calculated based on the maximum arrival rate (vehicles) divided by 60 minutes.
[4] Queue = vehicles per minute * 15 minutes. Fifteen minutes is assumed to be the maximum time a vehicle would wait for a parking spot.

Based on the information shown in **Table 12**, the maximum number of vehicles queued is estimated to be 26 during the weekday peak season and 31 vehicles during the peak weekend condition and also during the weekend off-peak condition. A vehicle queue at the parking lot entrance would only be expected to occur when the parking demand exceed the supply under any given alternative. **Table 4** shows the scenarios in which this is expected to occur (see shaded areas).

The maximum queue would be the same under each alternative because the location of the bottleneck, under a worse case scenario, would be at the parking lot entrance, regardless of the size of the parking lot.

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Preferred Alternative

A revised parking layout for the preferred alternative (B-4) includes a stacking area for approximately 15 vehicles.

Golden Gate National Recreation Area

Marin County Community Development Agency

Amendment to the Final Environmental Impact Statement/ Environmental Impact Report

Wetland and Creek Restoration at Big Lagoon, Muir Beach

SCH #2004042143

Prepared for:

Golden Gate National Recreation Area
National Park Service
Fort Mason, Building 201
San Francisco, CA 94123

Marin County Community Development Agency
3501 Civic Center Drive, Room 308
San Rafael, CA 94903

Prepared by:

Jones & Stokes
268 Grand Avenue
Oakland, CA 94610-4724

March 2008

The fundamental purpose of all units of the National Park Service is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

-From the National Park Service Organic Act, 1916, as amended.

Comments and Responses on the Final EIS/EIR

Introduction

This document serves as an amendment to the Final Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Wetland and Creek Restoration at Big Lagoon, Muir Beach (proposed project) which was prepared by the National Park Service (NPS) and the County of Marin (County). The purpose of this document is to respond to significant environmental concerns raised in the comments, per the requirements of the California Environmental Quality Act (CEQA). The Final EIS/EIR was circulated for public review from December 21, 2007 to February 4, 2008. This amendment contains the written comments received on the Final EIS/EIR during the public review period, and responses to each issue raised. There were no changes or updates to the Final EIS/EIR since publication and circulation for public review. This document will be included as an amendment to the Final EIS/EIR and will be considered together with the Final EIS/EIR at the time that NPS and the County consider it for approval.

During the public review period, ten written comment letters were received via parcel post or on the NPS' PEPC website, as listed in Table 1. Each comment letter is included in this amendment and has been assigned a letter, and comments within each letter are numbered consecutively (e.g., A-1, A-2, etc.) in the right margin adjacent to the individual comment. Each comment letter is followed by the NPS and County's response(s) to that letter. The responses are numbered to correspond with the comments as identified in the right margin of the letter.

Table 1. List of Commenters on the Final EIS/EIR

Comment Letter Number	Commenter	Date of Letter	Beginning on Page
A	Private	12/29/07	3
B	Ocean Riders, Maureen D. Pinto	1/26/08	5
C	Private	1/29/08	7
D	Private	1/30/08	9
E	Shere Stoddard	1/30/08	11
F	Sierra Club, Gordon Bennett	2/4/08	16
G	Kathy A. Sward	2/4/08	19
H	Kathy A. Sward	2/4/08	21
I	Greater Muir Beach Neighbors	2/4/08	24
J	Margaret Kettunen Zegart	2/4/08	27

Letter A

PEPC
Planning, Environment and Public Comment

GOGA > Wetland and Creek Restoration at Big Lagoon, Muir Beach (12126) > Public Documents > Wetland and Creek Restoration at Big Lagoon, Muir Beach Final EIS_EIR > Correspondence

Correspondence (1)

Edit
Enter More

Author Information

Keep Private: Yes
Name: [redacted]
Organization:
Organization Type: I - Unaffiliated Individual
Address: [redacted]
E-mail:

Correspondence Information

Status: New
Park Correspondence Log:
Date Sent: 12/29/2007
Date Received: 12/29/2007
Number of Signatures: 1
Form Letter: No
Contains Request(s): No
Type: Web Form
Notes: I e-mailed [redacted] on 1/4/08 asking if she would like a cd copy sent to her. Steve Ortega

Correspondence Text

I am unable to read/open the Big Lagoon Project Plans...
I have not had this problem with other documents... A-1

Thanks

Letter A: Private (12/29/07)

Response to Comment A-1

The Final EIS/EIR for the proposed project was available for downloading and review from websites hosted by the NPS and County, the addresses of which were stated in the public notices. All links were active during the public review period.

Letter B

PEPC
Planning, Environment and Public Comment

GOGA > Wetland and Creek Restoration at Big Lagoon, Muir Beach (12126) > Public Documents > Wetland and Creek Restoration at Big Lagoon, Muir Beach Final EIS_EIR > Correspondence

Correspondence (2)

Edit
Enter More

Author Information

Keep Private:	No
Name:	Maureen D. Pinto
Organization:	Ocean Riders
Organization Type:	I - Unaffiliated Individual
Address:	1760 Shoreline Hwy, Muir Beach, 94965 23 Castle Rock Dr. Mill Valley 94941 Muir Beach, CA 94965 USA
E-mail:	oceanridermp@prodigy.net

Correspondence Information

Status: New	**Park Correspondence Log:**
Date Sent: 01/26/2008	**Date Received:** 01/26/2008
Number of Signatures: 1	**Form Letter:** No
Contains Request(s): No	**Type:** Web Form
Notes:	

Correspondence Text

In response to comment M-2 and M-11 submitted for Ocean Riders in letter of March 5, 2007:
I would like for the record to say that it is Ocean Riders Mission to maintain the integrity of the land, water,flora and fauna, while preserving the historical presence of horses and ranching in Frank Valley. My letter in no way intended to diminish the importance of habitat restoration for the CRLF. We understand there are many endangered species on the GGNRA and support the mandate of the GGNRA to protect these species. We appreciate the more moderate approach to the Green Gulch 7th field reduction. That said, we hope to be able to work with Green Gulch for a Best Management Practice, which would include manure removal from that field on a more regular basis, and a possible period of 'rest' during the transition season, with the possibility that there can be four horses in the field during certain seasons. B-1 B-2
Regarding M-11: It is not ground water that impacts the paddocks, but the fact that they are in a depression, surrounded by 3 roads, with no outlet, so the first rain washes them out, and starts to pond, rendering them useless regardless if another month of dry weather follows. The possibility for an extended seasonal use of the pony paddocks could be remedied by better drainage. We hope we can keep a dialogue going about some potential changes that would not require fill, keeping the importance of any contaminated run-off contained. Impeccable manure removal would be crucial. Our hope is to use these paddocks on the shoulder season to be able to 'rest' the flat field for a short period when horses returned to the side hill. B-3
In response to M-4, we appreciate the possibility of paddock constructed to hold horses during the heavy construction of the bridge. We look forward to working with the Southern Marin Equestrian Plan to see how we can improve our Best Managemet Practices to prevent further loss of horse numbers. B-4
We thank everyone for the thoughtful replies to all of our concerns.

Letter B: Ocean Riders, Maureen D. Pinto (1/26/08)

Response to Comment B-1

Thank you for your comment. The NPS and County appreciate your support of the multi-beneficial outcomes of the proposed project.

Response to Comment B-2

The NPS supports the use of Best Management Practices (BMPs) for maintenance of horses pasturing in the Green Gulch Field 7, including more regular manure removal. The description of restoration activities in the Final EIS/EIR (page 2-12) recognizes a worst-case scenario of the possible loss of one horse from Field 7 due to project actions; however, it may be possible to implement BMP's that would both adequately protect water quality of the adjacent natural area and avoid the loss of one horse in the pasture.

Response to Comment B-3

The NPS and County recognize that water in the equestrian paddocks at the intersection of Highway 1 and Pacific Way is primarily due to surface water, not groundwater. The previous response to Comment M-7 in the Final EIS/EIR was intended to suggest that existing high groundwater elevations throughout the pasture – which are related to the aggraded elevation of the creekbed – reduce the rate of drainage at the site and promote longer periods of ponding. Once the new creek alignment is constructed and is somewhat deeper than the existing creek, groundwater elevations are expected to drop as much as 1 foot. There will still be periods of ponding and floodplain flows on the pasture area, but the lower groundwater elevations are likely to reduce the duration of ponding and create somewhat drier conditions. However, the paddock area, like the rest of the site, would still be a wetland under the jurisdiction of the U.S. Army Corps of Engineers and, as the commenter recognizes, NPS would not support placement of fill there.

Response to Comment B-4

Thank you for your comment.

Letter C

PEPC
Planning, Environment and Public Comment

GOGA > Wetland and Creek Restoration at Big Lagoon, Muir Beach (12126) > Public Documents > Wetland and Creek Restoration at Big Lagoon, Muir Beach Final EIS_EIR > Correspondence

Correspondence (3)

Edit
Enter More

Author Information

Keep Private: Yes
Name: [redacted]
Organization:
Organization Type: I - Unaffiliated Individual
Address: [redacted]
E-mail:

Correspondence Information

Status: New
Park Correspondence Log:
Date Sent: 01/29/2008
Date Received: 01/29/2008
Number of Signatures: 1
Form Letter: No
Contains Request(s): No
Type: Web Form
Notes:

Correspondence Text

I reside year round with my family just north of the project area, alongside Redwood Creek (which crosses my property) and just south of Hwy 1 and the Big Lagoon Bridge (the highway borders my property to the north). We experienced a severe flood on 12/31/05 when the creek jumped its banks and did over $250,000 damage to our home, landscape and vehicles. Just this past weekend (1/25/08) we came perilously close to inundation again after a winter storm dropped less than 6 inches of rain in the watershed. This is a two year event (so it seems to me anyway) occurring hundreds of yards upstream from Pacific Way and we were nearly wiped out again.

We are extremely vulnerable to flooding as we also reside in the floodplain, this is a fact, but events leading to flooding are increasingly frequent. It is clear that our risk of flooding has been increased over the years by the construction of agricultural improvements downstream as well as the creation and enlargement of the Muir Beach parking lot as well as the very small bridge at Pacific Way. Lastly of course the extraordinary buildup of sedimentation so clearly described in the EIS is a serious problem. C-1

We are so thrilled to live here in the midst of such extraordinary beauty but we are fearful each winter of being flooded. In my opinion the restoration planned for Big Lagoon is absolutely essential and must proceed as quickly as possible. I have reviewed the alternatives and am strongly in favor of the implementation of the preferred alternative as described on page 44. I am basically in favor of the largest possible bridge and causeway. I am in favor of rapid restoration of the creek in advance of the start of the lagoon restoration, ie. dredging the creek bed to reduce the risk of flooding as soon as possible. I am in favor of not postponing bridge construction since the low bridge is one of the most direct obstructions to normal flows on the creek. C-2

I am so impressed by the quality and thoroughness of the EIS/EIR. I am pleased to have been kept informed by GGNRA staff as this project has advanced. I plan on residing here for years to come and hope that in the future I won't have to haul dozens of sandbags around my house everytime a winter storm rolls off the Pacific. If I can be of any assistance to the advancement of this project please let me know. Thank you for all your excellent work. We all, humans, dogs, cats, salmonids, amphibians, thank you. C-3

Letter C: Private (1/29/08)

Response to Comment C-1

Thank you for your comment. The NPS and County both recognize the importance of improved flow conveyance and sediment transport in Redwood Creek. The proposed project would reduce flood elevations under frequent, small- to moderate-magnitude flood events by removing the hydraulic obstructions created by the parking lot, narrow bridge, and agricultural levees. Under infrequent, large-magnitude flood events, such as a 50- or 100-year flood, flood elevations under the project conditions would remain relatively unchanged compared to the existing condition.

Response to Comment C-2

The NPS and County appreciate your support of the Bridge Alternative BR4 and Restoration Alternative 2. The final design and construction schedule of the Pacific Way Bridge will be determined by Marin County, in coordination with NPS, based on funding availability.

Response to Comment C-3

Thank you for your comment.

Letter D

PEPC
Planning, Environment and Public Comment

GOGA > Wetland and Creek Restoration at Big Lagoon, Muir Beach (12126) > Public Documents > Wetland and Creek Restoration at Big Lagoon, Muir Beach Final EIS_EIR > Correspondence

Correspondence (4)

Edit
Enter More

Author Information

Keep Private: Yes
Name: [redacted]
Organization:
Organization Type: I - Unaffiliated Individual
Address: [redacted]
E-mail:

Correspondence Information

Status: New
Park Correspondence Log:
Date Sent: 01/30/2008
Date Received: 01/30/2008
Number of Signatures: 1
Form Letter: No
Contains Request(s): No
Type: Web Form
Notes:

Correspondence Text

I am 82 years old and have lived alone at 1795 Shoreline Highway next to Redwood Creek just south of the Big Lagoon bridge on Highway 1 for over 6 years, and intend to continue here for the duration of my lease ending in 2014.

At 6:30 am on New Year's morning, 2006, a volunteer fireman led me to safety through 2 1/2 feet of water in my livingroom. My 1997 Volvo was totaled. An inch of mud was deposited on my first floor. The deep water damaged my Steinway piano and other family heirlooms. I couldn't return for 10 days. The cleanup cost thousands of dollars.

Only 2 years later, on the weekend of 1/25/08, a lesser storm added 6 inches of water to the water table. 6 inches of water surrounded my house and came up 6 inches in my lower rooms, preventing me from coming home from the hospital after my pacemaker had been installed on 1/25/08.

PLEASE IMPLEMENT THE PREFERRED ALTERNATIVE RESTORATION PLAN FOR BIG LAGOON AS DESCRIBED ON PAGE 44. PLEASE DREDGE THE CREEK AND CONSTRUCT THE BIDGE AS SOON AS POSSIBLE TO AVOID A REPETITION OF THE FLOODING. It is hard to imagine the hardship of yet another flood. D-1

I am grateful for your attention to this whole problem and so appreciate your ongoing attention to the sensitive nature of this natural environment. I remember, Carolyn, when you personally rescued all the baby salmon from the creek.

Sincerely,

[redacted]

Letter D: Private (1/30/08)

Response to Comment D-1

Thank you for your comment. The NPS and County appreciate your support of Bridge Alternative BR4 and Restoration Alternative 2. The final design and construction schedule of the Pacific Way Bridge will be determined by Marin County, in coordination with NPS, based on funding availability.

Letter E

January 30, 2008
To: GGNRA
Fr: Shere Stoddard
Re: Wetland & Creek Restoration at Big Lagoon Muir Beach

Thank you for allowing me the opportunity to comment on the final EIS/EIR on the above project. My concerns are on my behalf alone and do not represent my neighborhood nor the Muir Beach Community Services District.

My concerns are the following:

- **November 7, 2007 Cosco Busan Oil Spill:**

1. What about the Oil SPILL?
2. What damage did bunker fuel do to the wildlife?
3. How long will it take for the environment to recover from the thousands of gallons of oil we witnessed?
4. Why are we pushing this project through when we do not fully understand the long term effects of the Oil Spill on the Redwood Creek and it's inhabitants? E-1
5. Have we compared the health of Redwood Creek before and after bunker fuel surged up Redwood Creek?
6. What kind of offspring will result from damaged sea life?

I walked the creek, I saw the oil, day after day. The sea life was dead or severely injured. Prior to the OIL SPILL there were more Coho Salmon in Big Lagoon than I had seen in years. There was reason for hope for a new beginning, a slim chance albeit. In my opinion, the slim chance before the OIL SPILL is severely in question now.

- **Budget Concerns:**

1. Where and when will Marin County get the money to build the bridge? E-2
2. Could the money from the NPS for Big Lagoon either not be there or the direction of the money change during the project life? E-3
3. Could the project be left without the money and unfinished? E-4
4. Shouldn't the bridge be built first? E-5
5. With State Parks closing is it possible this project may be postponed? E-6

6. Should we spend $14.5m taxpayer dollars on Big Lagoon when we do not have money to feed and house people right now? E-7

➢ **Life Environment Concerns:**

1. Documents point out that the mosquito population will grow during the many years of this project? E-8
2. Could the horses or humans at Muir Beach be harmed by the increase in the mosquito population?
3. Who will decide what measures will be taken for mosquito abatement at Big Lagoon? Will it be Marin County or the NPS? E-9
4. Will we be allowed to control the mosquito population at Big Lagoon via Marin County mosquito abatement program that we voted and pay for? E-10
5. Suppose the mosquito's dine on CRLF eggs? E-11
6. Why did we compromise and agree to spawn CRLF at Big Lagoon when it is not a native species to Muir Beach? The CRLF is being reintroduced up and down the entire West Coast from the info available on the internet. E-12

I am quoting the Marin IJ Jan 29,2008

"**Missing coho in Redwood Creek may be latest fallout of oil spill**
Mark Prado
Article Launched: 01/29/2008 11:22:09 PM PST

Spawning endangered coho salmon have yet to appear in Redwood Creek, raising fears that Cosco Busan oil spill may have driven the fish away.

"No coho have come up Redwood Creek so far this year," said Steve Hampton, of the state Department of Fish and Game, at a meeting Tuesday night in Mill Valley to discuss the effects of the spill on Marin.

"They should be up by now," he said. "It has been a low year for coho up and down the coast, but Redwood Creek is the only zero."

E-1, cont

The Redwood Creek coho salmon run comes from the Pacific Ocean and through Muir Beach, where the fish congregate waiting for seasonal rains to break a berm at the beach. They can then travel up the creek and spawn. Visitors can usually see the spectacle at Muir

Woods, but not this winter.

Muir Beach was hit hard by the oil spill. Fish find their home stream based on odors.

"Maybe the oil confused them and they thought it wasn't their stream," Hampton said.

E-1, cont

Based on the lowest expected ocean survival rates for the region - in the 3 percent range - between 81 and 113 adult coho spawners should be in Redwood Creek, according to the Lagunitas-based Salmon Protection and Watershed Network.

"This may be the first time since the National Park Service

began inventorying salmon in this watershed in 1997/98 that no coho spawning has been documented here," SPAWN wrote in a letter to a team of governmental officials that met in Mill Valley to collect data on the spill.

E-1, cont

Sincerely,

Shere Stoddard
85 Sunset Way
Muir Beach, Ca 94965
415-984-7174
shere.stoddard@macys.com

Letter E: Shere Stoddard (1/30/08)

Response to Comment E-1

Thank you for your comment. The Cosco-Busan oil spill in San Francisco Bay on November 7, 2007 did reach Muir Beach and the Redwood Creek tidal lagoon, affecting the shoreline habitat and wildlife. Muir Beach was closed to the public during clean-up activities. Since the initial response to clean up the oil, state and federal trustee agencies, including the NPS, have been working in cooperation with cities, counties, and other organizations to assess the ecological injuries and human use losses caused by the spill. This process, known as the Natural Resource Damage Assessment (NRDA), works to collect time-critical data and analyze the data to quantify the injuries to wildlife, habitat, the lost use of resources, and to develop a restoration plan. The trustees will ultimately make a claim for funds from the responsible party to implement restoration projects designed to both restore and compensate for the injured resources and human activities. The NRDA results are not available at this time. The NRDA process was discussed in two public meetings in January 2008, and additional meetings will be held in the future. The proposed restoration plan will be released for public comment. Updated information about this process is posted at the following web sites: dfg.ca.gov/ospr/spill/nrda/nrda-cosco-busan.html, response.restoration.noaa.gov, and coscobusanincident.com.

The proposed restoration actions in this project offer important benefits to fish and wildlife. There is no indication that the impacts of the oil spill would warrant delaying the project implementation.

Response to Comment E-2

The bridge is not proposed to be funded by the Marin County general fund. Marin County is seeking funds from other sources, such as federal grants, to pay for the bridge construction.

Response to Comment E-3

The NPS is not paying for the restoration actions from its operating budget. Some Fee Demonstration funds, which are generated from visitor entrance fees, will be used for a portion of the restoration actions. The remaining cost will be paid for through grants. About 60% of the needed funds are committed at this time. The NPS does not expect that funds committed to the project would be lost.

Response to Comment E-4

A wide range of scenarios are possible; however, the NPS and Marin County are committed to completing the project as described in the Final EIS/EIR.

Response to Comment E-5

Phasing of bridge construction will be finalized as part of project design. It is preferable for the bridge to be constructed as one of the initial actions; however, it may be possible to construct some other components in advance of the bridge, particularly if it is temporarily delayed due to funding or other reasons. The Final EIS/EIR disclosed that construction of the Pacific Way bridge could occur following other actions, but the actual schedule will be determined during the design phase (page 2-35 in the Final EIS/EIR) based on funding availability.

Response to Comment E-6

Muir Beach is component of the Golden Gate National Recreation Area (GGNRA), which is a unit of the NPS, a federal agency. Current and future state management policies and funding changes would not affect operation of this park on federal land.

Response to Comment E-7

Comment noted. Project construction costs are not a subject analyzed under the CEQA Guidelines. However, in general, funds for the restoration actions are typically from grant sources that are already targeted for ecological protection, endangered species enhancement, long-term conservation, and similar purposes.

Response to Comment E-8

The Final EIS/EIR concludes that the combined extent of emergent wetland and open water systems would be greatly reduced in Restoration Alternative 2, and the amount of low-velocity areas allowing mosquito breeding would be decreased compared to existing conditions (page 4-58 in the Final EIS/EIR).

The Final EIS/EIR also discloses that mosquito abatement activities would occur through the 50-year life of the project (page 2-41 in the Final EIS/EIR). Monitoring for larval mosquitoes will occur when surface water is present. Should numbers be present at levels sufficient to pose public health risks, the NPS' Integrated Pest Management (IPM) coordinator will treat the ponded areas with a biological control agent (*Bacillus thuringensis*), which is commonly used and does not impact other aquatic life. This action would adequately protect people and wildlife from potential risks of disease carried by mosquitoes.

Response to Comment E-9

As stated in response to comment E-8, the NPS' IPM coordinator is responsible for identifying and implementing mosquito abatement activities on the project site. The Marin-Sonoma Mosquito Abatement District works under direct supervision of the GGNRA to assist in addressing vector-borne disease issues.

Response to Comment E-10

The NPS' IPM coordinator is responsible for identifying and implementing mosquito abatement activities, including direction of the Marin/Sonoma Mosquito Abatement District, on the Big Lagoon site. In 2003, Sonoma and Marin County voters approved annexation of the unincorporated areas of Marin and Sonoma County into the Marin/Sonoma Mosquito Abatement District. The commenter is correct in that this voter approved measure will contribute to mosquito abatement at Big Lagoon.

Response to Comment E-11

Mosquitoes generally feed on flower nectar and fruit juice; only females may bite animals or humans to obtain the nutrients (proteins and iron) in blood necessary for reproduction. Mosquitoes are unlikely to impact California red-legged frog (CRLF) egg survival rates at the Big Lagoon site.

Response to Comment E-12

The CRLF is named on the federal Endangered Species List as threatened and named on the state Endangered Species List as a species of special concern. Although the project site is not within Critical Habitat as designated by the U.S. Fish and Wildlife Service (74 FR 19244-19346), a CRLF population is present and documented in the Redwood Creek watershed, but its numbers are critically low. The continued existence of this federally and state-listed species is in jeopardy. As such, there is an urgent need to provide hydrologically sustainable habitat for CRLFs on this site.

The project is proposing actions for the CRLF habitat in part because NPS management policies state that the NPS will "survey for, protect and strive to recover all species native to national park system units that are listed under the Endangered Species Act." The NPS will fully meet its obligations under the NPS Organic Act and the Endangered Species Act to both proactively conserve listed species and prevent detrimental effects on these species (NPS Management Policies 2006, Section 4.4.2.3).

Letter F

PEPC
Planning, Environment and Public Comment

GOGA > Wetland and Creek Restoration at Big Lagoon, Muir Beach (12126) > Public Documents > Wetland and Creek Restoration at Big Lagoon, Muir Beach Final EIS_EIR > Correspondence

Correspondence (8)

Edit
Enter More

Author Information

Keep Private:	No
Name:	Gordon Bennett
Organization:	Sierra Club
Organization Type:	I - Unaffiliated Individual
Address:	Inverness, CA 94937 USA
E-mail:	gbatmuirb@aol.com

Correspondence Information

Status: New	**Park Correspondence Log:**
Date Sent: 02/04/2008	**Date Received:** 02/04/2008
Number of Signatures: 1	**Form Letter:** No
Contains Request(s): No	**Type:** Web Form
Notes:	

Correspondence Text

SIERRA CLUB MARIN GROUP
Box 3058 San Rafael CA 94912 sanfranciscobay.sierraclub.org/marin
c/o Gordon Bennett 40 Sunnyside Dr Inverness CA 94937
415-663-1881/gbatmuirb@aol.com

February 3, 2008

TO: Golden Gate National Recreation Area (GGNRA) Attn: Superintendent
@ http://parkplanning.nps.gov/goga

The Sierra Club offers the following comments on Wetland and Creek Restoration at Big Lagoon Final Environmental Impact Statement/Report (FEIS/R):

We appreciate the FEIS/R's change of its preferred alternative to the longest and most fish friendly bridge as recommended by the Sierra Club. We also appreciate the FEIS/R commitment to the narrowest and most community-friendly bridge and we urge that this narrowing be aggressively pursued during the design phase. F-1

However, we are disappointed that the FEIR/S still indicates that the long-promised transfer of Zen Center's water rights, a critical project component, has not been completed. The Sierra Club may consider petitioning the State Water Board for administrative transfer in order to provide for the dedication of this right to in stream uses per Water Code Section 1707. F-2

Lastly, our comment on the Draft EIS/R suggested that the western-most ~50 foot section of the coastal trail/fire road below the Green Gulch Trail intersection be re-routed a few feet higher along the base of the hill and then extended another ~50 feet to access the beach at the front of the dunes instead of its current access F-3

at the back of the dunes. The FEIS/R response appears not to understand that when the rip-rap and levee trail are removed as planned, then this western-most section of the fire road will dead-end in water and/or wetland and will thus no longer provide emergency beach access during storms or high tides. The proposed extension to the front of the dunes would protect this sensitive habitat from emergency equipment as well as provide a point from which ranger vehicles can overlook and access the beach. Such an overlook will become important since the project design significantly increases the distance from the parking lot to the beach and thus makes enforcement on-foot less likely. This extended segment of the fire road could also be used to provide ADA access to the beach. F-3, cont F-4

Thank you for the opportunity to comment

Gordon Bennett, Conservation Chair

Letter F: Sierra Club, Gordon Bennett (2/4/08)

Response to Comment F-1

Thank you for your comment. The NPS and County appreciate your support of Bridge Alternative BR4. Marin County will work to minimize the bridge width during the design phase, while meeting all safety and road construction requirements.

Response to Comment F-2

Comment noted. The need to prevent a possible water diversion from the project site under an appropriative water right owned by the San Francisco Zen Center (SFZC) is recognized in the Final EIS/EIR. This issue will be addressed in an overall agreement to be made between NPS and SFZC, in which NPS will acquire a conservation easement for about 14 acres at the project site. Work on the agreement is progressing but is not final yet.

Response to Comment F-3

The suggestion to reroute the western-most 50 feet of the Coastal Trail a few feet higher along the base of the hill and extend the trail to the beach across the front of the dunes will be considered during design preparation. Please note, however, that the emergency access is generally needed to the Coastal Trail and bluffs, not to the beach.

Response to Comment F-4

Thank you for your comment regarding the possible rerouting of the lower portion of the Coastal Trail to the beach. It is not clear that a reroute would better meet Americans with Disabilities Act (ADA) standards, but the suggestion will be considered during the preparation of construction designs.

Letter G

PEPC
Planning, Environment and Public Comment

GOGA > Wetland and Creek Restoration at Big Lagoon, Muir Beach (12126) > Public Documents > Wetland and Creek Restoration at Big Lagoon, Muir Beach Final EIS_EIR > Correspondence

Correspondence (11)

Edit
Enter More

Author Information

Keep Private: No
Name: Kathy A. Sward
Organization:
Organization Type: I - Unaffiliated Individual
Address:
Muir Beach, CA 94965
USA
E-mail:

Correspondence Information

Status: New
Park Correspondence Log:
Date Sent: 02/04/2008
Date Received: 02/04/2008
Number of Signatures: 1
Form Letter: No
Contains Request(s): No
Type: Web Form
Notes:

Correspondence Text

Dear Brian O'Neill,

We wrote you regarding our concern about the public transit issues for Muir Beach and the size of the causeway being out of character with the rural aspect of this community.

We are now writing to remind you that in the past we have asked for a "shrinking parking lot", based on our getting a great public transit system to serve the residents, but more importantly, visitors to the beach. Our theory, which I believe should be the Park's also, is that more people would use transit, given a really good schedule, rather than having to drive around and around the parking lot searching for a spot on a busy day. Fewer parking spaces would be needed and therefore, in time the parking lot would be made smaller. It should be the hope of all of us that this would be the case, and thus there would be fewer cars on the road; therefore, again I want to remind you that the project needs to have in the plan how to create a smaller parking lot once we see the success of the transit – a "shrinking parking lot". G-1

I also want to again mention the possibility of the plan including a boardwalk around, and sometimes across marsh areas, of the lagoon as another route to get to the beach from the highway and the Pelican Inn , rather than just the road. It could be absolutely lovely, with observation areas with benches as had been previously mentioned, for resting or just stopping to watch and listen – another type of experience at the lagoon. G-2

I hope both these suggestions will again be included in the Lagoon Project, or at least could be incorporated at a later date.

Thank you for your attention,

Kathy and John Sward

Letter G: Kathy A. Sward (2/4/08)

Response to Comment G-1

Thank you for your comment. The Final EIS/EIR recognizes that if public transit opportunities become available and parking demand declines after project implementation, the NPS could take separate actions at that time to reduce the size of the parking lot (page 2-43 in Final EIS/EIR.) At this time, there is no public transit to the site and demand for personal vehicle parking is expected to remain at current levels or increase. There would be increased impacts to traffic, congestion on Pacific Way, and visitor experience if the size of the parking lot was reduced without available public transit.

Response to Comment G-2

Thank you for your comment. The project will include a perimeter trail along the outer edges of the wetland area, following the existing alignment of the Green Gulch access road and trail from Green Gulch to the beach. The design may include viewing areas or possibly bird blinds at the edges of the wetland areas. However, boardwalks across the wetland area are not proposed in order to keep impacts of human use at the edges of the natural area.

Letter H

PEPC
Planning, Environment and Public Comment

GOGA > Wetland and Creek Restoration at Big Lagoon, Muir Beach (12126) > Public Documents > Wetland and Creek Restoration at Big Lagoon, Muir Beach Final EIS_EIR > Correspondence

Correspondence (9)

Edit
Enter More

Author Information

Keep Private:	No
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Correspondence Information

Status: New	**Park Correspondence Log:**
Date Sent: 02/04/2008	**Date Received:** 02/04/2008
Number of Signatures: 1	**Form Letter:** No
Contains Request(s): No	**Type:** Web Form
Notes:	

Correspondence Text

Dear Brian O'Neill,

First of all we want to say how grateful we are for the causeway which will clearly answer some of our concerns with respect to the flooding in the lowlands, but it absolutely has to be sensitive to the rural character of this area. Thank you for understanding the importance of this, not just to us, but for all who love Muir Beach. H-1

But we don't understand how we're at a point in time where we're poised to really change things, to make Muir Beach, our home, a showcase for the larger world, yet one aspect of the project is clearly missing the point; in particular, the public's access to this beautiful parkland seems to be secondary and not terribly important in the big picture.

Instead of thanking those environmentally-conscious people who would choose to get out of their cars to ride public transit, like our lost Stage, which could take them right to the beach parking lot, it is being proposed to have them share the Shuttle which is meant to take visitors to Muir Woods. Under this plan, beach-goers would be dropped off at the highway by the Dairy, where they would have to gather all their beach paraphernalia and kids etc., and cross the highway, then walk alongside all the gas-spewing vehicles that are rushing by to park right next to the beach. Something's not right... H-2

Also, a stop on the highway at Muir Beach would require a large ADA stop at our mailboxes and also on the other side of the highway. Then a 6 or 8 foot wide ADA approved walkway would be required to go beside the 20-24 foot wide causeway, which would now be 32 feet wide. People would then continue down the road and through the parking lot to the bridge to the beach. Much better just to hop into your car and drive to the beach! Clearly this is not a solution for which the National Park people should be proud. H-3

We currently have a road and bridge varying in size from only 17 to 20 feet of width. It has served walkers, bikers, cars and trucks, horses and dogs for many years with never a problem, except for traffic jams on busy days. And happily the new rearranged parking lot is wisely being planned to have stacking room to deal with beach traffic; we're very thankful for this improvement. H-4

Please see that public access to this park is a very important issue, and it needs to be seen as just as important as any other part of the Lagoon Project. The Muir Woods Shuttle may be a convenient solution, but it is not the right one. It was also shocking to see it in the Final Document, even though it was barely discussed with Muir Beachers.

The Lagoon Project needs to speak to the fact that it is absolutely essential to design the parking lot with a public transit stop built into it, preferably near the walking bridge leading to the beach. Our old Stagecoach, or a similar vehicle, is perfect to accommodate not only visitors to the beach, but also visitors to the Pelican Inn and residents of Muir Beach. Now is when we need to plan for the future and recognize that quality public transit has to be the wave of the future, and it needs to be designed so that it serves the public well so that it will be utilized. H-5

The current proposal to start the Dial-A-Ride program could be a very successful means of transport to get people to the parking lot, especially if it were advertised as well as the Muir Woods Shuttle is, and, if successful, would likely be able to grow back into our cancelled Stagecoach. With a much more useful (with a full schedule) system, the Stage would speak to many of our concerns, concerns that should also be yours. H-6

Please give our concerns your attention, and we thank you in advance.

Sincerely,

Kathy and John Sward

Letter H: Kathy A. Sward (2/4/08)

Response to Comment H-1

Thank you for your comment. The NPS and County appreciate your support of Bridge Alternative BR4, and recognize the importance of designing a bridge that is appropriate for a rural character of the area.

Response to Comment H-2

It is challenging to fund public transportation service to remote areas, especially when ridership is low, as was reported for the Stage. The Muir Woods shuttle was developed by Marin County Public Works as a three pilot program using federal grant funds. The three year pilot program ended in 2007. The Marin County Transit District (MCTD) Board of Directors at its meeting on January 28, 2008 conceptually approved to support this shuttle operation as part of the MCTD local service in partnership with the NPS for the years 2009 to 2011. To continue service while the details of the partnership are worked out, Marin County Public Works will extend the pilot program for another year using federal grant funds to cover the operation during summer months of 2008. Thus, although it is very successful in drawing users who leave their cars behind, even this well-used service is not financially self-supporting.

A possible drop-off by the Muir Woods shuttle at Highway 1 and Pacific Way, as is being considered by Marin County, would allow visitors to reach Muir Beach through this existing public transportation service that has a likelihood of continuing due to its significant ridership. As an additional consideration, note that studies conducted by the Comprehensive Transportation Management Plan for Southern Marin showed that public transportation to Muir Beach would be substantially more difficult to finance if a bus drove all the way to the visitor parking lot instead of stopping at Highway 1 and Pacific Way. The added time spent driving to the parking lot would substantially increase the total time of a round-trip, thereby reducing total bus trips and increasing visitor's waiting periods for bus service.

Also, the MCTD at its meeting on February 25, 2008 approved a Muir Beach Dial-A-Ride Transit Demonstration Project. For more information, please contact MCTD.

Response to Comment H-3

Marin County is considering a separate project to create a stop for the Muir Woods shuttle at the intersection of Highway 1 and Pacific Way. As of 2007, the shuttle also stopped at the Sausalito ferry terminal, allowing visitors to leave San Francisco by ferry to reach Muir Woods National Monument. If a shuttle stop is provided on Highway 1 at Pacific Way, it would be possible to travel easily from San Francisco to the beach without the use of a car. The new trail from Highway

1, over the new bridge, along the edge of Pacific Way and the wetland area to the beach will enhance the aesthetic qualities of the walk to the beach. ADA compliance is a required component of the trail. The County is aware of the need to minimize the design width of the bridge, but the Final EIS/EIR recognizes a maximum width of up to 32 feet, including 6 feet for the pedestrian path.

Response to Comment H-4

Thank you for your comment. The NPS and County appreciate your support of Public Access Alternative B4. With a new 250-foot-long Pacific Way Bridge, it is necessary to have a pedestrian component for safety reasons. The attached trail will enhance the aesthetic quality of walking to and from the beach, in addition to reducing conflicts between pedestrians and cars on busy summer days. While the Final EIS/EIR recognizes the possibility that the bridge may extend up to 32 feet wide, Marin County will work during the design phase to minimize the bridge width while meeting road safety standards.

Response to Comment H-5

While a transit stop is not proposed to be included at the new parking lot, the long-term prospect of a transit stop may be taken into consideration when the parking lot is designed so that public transportation to the beach could be accommodated with relatively minor adjustments if it becomes available. The Muir Woods shuttle was referenced in the Final EIS/EIR as a separate public transit project under consideration by Marin County.

Response to Comment H-6

The NPS and Marin County will continue to work with members of the community to accommodate public transportation.

Letter I

PEPC
Planning, Environment and Public Comment

GOGA > Wetland and Creek Restoration at Big Lagoon, Muir Beach (12126) > Public Documents > Wetland and Creek Restoration at Big Lagoon, Muir Beach Final EIS_EIR > Correspondence

Correspondence (10)

Edit
Enter More

Author Information

Keep Private:	Yes
Name:	[redacted]
Organization:	Greater Muir Beach Neighbors
Organization Type:	I - Unaffiliated Individual
Address:	[redacted]
E-mail:	

Correspondence Information

Status: New	**Park Correspondence Log:**
Date Sent: 02/04/2008	**Date Received:** 02/04/2008
Number of Signatures: 1	**Form Letter:** No
Contains Request(s): No	**Type:** Web Form
Notes:	

Correspondence Text

Dear Brian O'Niell,

Thanks to you and your staff for all the work in seeking out and incorporating public comment on the Wetland and Creek Restoration at Big Lagoon project. This project is important to many who love this area and will certainly enhance the stream flow and ecological health of Redwood creek and the adjacent wetland.

We are still very concerned that the National Park Service and the County are planning the causeway for the Big Lagoon project around a transit concept to add two massive, concrete bus stops on Highway 1 so that the large Muir Woods tourist buses (that are currently overfilled with tourists heading to Muir Woods) can stop at Muir Beach every 20 minutes. This is essentially a proposal to entice Muir Woods visitors to stop at Muir Beach, a stop they never intended to make. Meanwhile, NPS and the County continue to ignore the request for public transit geared to those intending to come to Muir Beach so they can get out of their cars and be dropped off at Muir Beach. The rationale for ignoring beach visitor transit is that transit is not part of this project, yet the proposed Muir Woods Bus stop is driving the causeway design. I-1

The Muir Woods Bus stop at Muir Beach is being pursued behind closed doors. This must stop. Bring the proposal to the community for an open and thorough review and don't design the causeway around a faulty concept. I-2

Transit to Muir Beach must afford the transit user the same privileges – being delivered to the beach parking lot – as the driver. Requiring a lengthy walk to the beach is unfair and impractical for many. I-3

We are in favor of the longer causeway, as it provides for a crucial element of the project, the ability of the creek to meander and thus maximize stream flow and fish migration. I-4 We are opposed to widening of the causeway beyond the minimum width necessary, preferably its current width of 20 feet (plus railings, etc.), with I-5

non-motorized traffic using a combination fire trail/board walk to get to the beach. This would help to minimize the cost and the visual and environmental impact of the causeway. I-6

As this project moves into design, please incorporate local features and landmarks into the drawings such as houses, trees, parking lot and levy features, etc. It will make the plans much easier to understand. I-7

Thank you in advance for addressing these concerns.

Sincerely,

[redacted]
Greater Muir Beach Neighbors

Letter I: Greater Muir Beach Neighbors (2/4/08)

Response to Comment I-1

The Pacific Way Bridge, a 250-foot-long bridge that will appear as a causeway, is proposed because it will allow the creek and floodplain to function naturally while providing vehicular access to residents and visitors during winter flood events. The impetus for the bridge and its pedestrian component is not the Muir Woods shuttle. The bridge must provide a pedestrian component for safety reasons – and it must legally meet ADA standards – but it will also enhance the visitor experience by linking to a trail along the natural area. The existence of the new trail along the wetlands and on the new Pacific Way Bridge does create the opportunity to link to a bus stop for the Muir Woods shuttle, thereby expanding public transportation access to the site. At this time, the Muir Woods shuttle presents the most plausible opportunity to offer public transportation to the site since it has significant ridership and is thus able to secure grants to fund its operation. Other public transportation services to the site have failed due to low ridership and the difficulty in funding their operations. The possible shuttle stop at Highway 1 and Pacific Way is not a component of this project and is being considered separately by Marin County.

Response to Comment I-2

The bus pull-off on Highway 1 at Muir Beach will be addressed by the County in a separate public planning and review process.

Response to Comment I-3

A drop-off at Highway 1 may not be the most desirable visitor experience, but it is currently the most plausible scenario for providing public transportation service to the site since the Muir Woods shuttle has substantial ridership and has therefore been able to secure funding by grants. As an additional consideration, note that studies conducted by the Comprehensive Transportation Management Plan for Southern Marin showed that public transportation to Muir Beach would be substantially more difficult to finance if a bus drove all the way to the visitor parking lot instead of stopping at Highway 1 and Pacific Way. The added time spent driving to the parking lot would substantially increase the total time of a round-trip, thereby increasing a rider's time on the bus, reducing total bus trips and increasing visitor's waiting periods for bus service. Also, since the Muir Woods shuttle now stops at the Sausalito ferry, it is possible for a visitor to leave San Francisco by ferry and reach the beach without the use of a car. While a visitor might prefer to be dropped off closer to the beach, many visitors might find a walk to the beach along the natural area to be a pleasant experience.

Response to Comment I-4

Thank you for your comment. The NPS and County appreciate your support of Bridge Alternative BR4, which maximizes stream flow and fish migration.

Response to Comment I-5

Comment noted. While the Final EIS/EIR recognizes the possibility that the bridge may extend up to 32 feet wide, Marin County will work during the design phase to minimize the bridge width while meeting road safety standards.

Response to Comment I-6

The new Pacific Way Bridge must be designed so that the elevation of the underside of the deck does not obstruct flood flows. An obstruction could cause water to back up, increasing the elevation of floodwaters upstream of the bridge. If a separate pedestrian bridge or boardwalk were built to cross the creek and floodplain, it would have to be as high as the new bridge to avoid creating an obstruction. It would be significantly more expensive and more visually intrusive to build a separate structure for a pedestrian crossing.

Response to Comment I-7

The NPS and Marin County will incorporate local landmarks into design drawings as appropriate.

Letter J

MARGARET KETTUNEN ZEGART
118 HIGHLAND LANE
MILL VALLEY, CA 94941

February 4, 2008

Steve Ortega, Environmental Protection Specialist
Golden Gate National Recreational Area
Building 201
San Francsisco, CA 94123

cc: Brian O'Neal

RE: Wetland and Creek Restoration at Big Lagoon Draft Environment Impact State/Environmental Impact Report

Dear Mr. Ortega and Mr. O'Neal:

Replacing the Pacific Way Bridge and modifying Pacific Way is to provide a sufficient safe and aesthetic Alternative BR4: 266+foot long bridge with the highest road since BR 3 only addressed one "soon obsolete"10 yr flood condition. Important in the Wetland and Creek Restoration at Big Lagoon is the alternate not chosen Because of increased now anticipated climate change since the RDEIR seems the longest alternative to the bridge is most appropriate as depicted on maps at the recent presentation at the Bay Model. J-1

° However, local residents are concerned about the width which includes.multi–purpose pathway and their concern a wide bridge will initiate increased tourist activity that will result in habitat damage not anticipated by present use. J-2

° Although not the current preferred alternative, the longest bridge may be the most appropriate in the event of increased flooding risks and tidal ocean rise and tsunami – allowing a wider expanse of water flow. Cost seemed the decision factor and this can be rebutted by long term increasingly frequent flood events' costs to Marin and the National Park system. J-3

° A multi-purpose bicycle and pedestrian use alternative separate bridge might be considered in the FEIR if the two way bridge including the multipurpose lanes is too wide.. There should be some barrier on a multipurpose lane and trails to prohibit Recreational Vehicles' access. J-4

No Off-road Recreational Vehicles (ORV) should be permitted. Bicycles and motorcycles should be prohibited and ticketed on trails, beach and parking lot. ORV's are problem elsewhere. J-5

.° **The reconfigured Muir Beach parking lot** as mapped for presentation does not indicate a loading zone for shuttle (mini-bus) passengers nor secured bicycle parking areas. The location of restrooms and kiosks and trail entry to the beach should be indicated. Lagoon, trails and beach areas should be pedestrian oriented access only; attractive with habitat palnting. Elevated "boardwalk" (Trex) trails should protect year round any wetland areas. An advantage of the reconfigured lot is its shifting with no loss of parking places. However handicapped spaces and shuttle provisions should be provided and before the new parking lot accesses visitors. J-6 J-7 J-8 J-9 J-10

1. No Parking fees should not be charged as they represent use charge prohibited in by GGNRA founding restrictions. J-11

2. Mitigation to allow local users of the beach early adjacent Beach parking in this area prior to GGNRA visitors' bus drop off consistent with park use J-12

3. Mitigation of transit plan spaces would focus on and benefit increased transit schedule to Muir Woods Route and GGNRA West Marin destinations for visitors from larger Bay Area and national and international places to change 94% visitors who arrive by private vehicles. J-13

° **Trails** Connections should include a rambling trail to follow the newly aligned creek and its wider under pass underneath Pacific Way Bridge to its mouth at the Pacific. Seating for passive enjoyment of the park (and for seniors and disabled) should be along the trails as well as informational enrichment for visitors. Information about the many species in the area that are at risk including the California Red legged frog, Coho Salmon and trout should be in several languages for self interpretation along the trail. J-14 J-15 J-16

Sincerely,

Margaret Kettunen Zegart

Margaret Kettunen Zegart

Letter J: Margaret Kettunen Zegart (2/4/08)

Response to Comment J-1

Thank you for your comment. Bridge Alternative BR4 provides the longest feasible bridge span (250 ft) and highest road deck (16.25-18 ft) in order to accommodate peak flood flows. Selection of this alternative was based partially on the uncertainties in flood elevations related to future sea level rise.

Response to Comment J-2

The Final EIS/EIR recognizes that the new bridge width may be up to 32 feet wide, including two traffic lanes, railings, a shoulder, and the new pedestrian path; however, Marin County will work during design preparation to minimize the bridge width while meeting road safety standards. There is no indication that the new bridge or pedestrian path will directly result in increased visitation to Muir Beach.

Response to Comment J-3

While the preferred Bridge Alternative BR4 is the most expensive bridge alternative, it provides substantially better benefits than other bridge alternatives because it will accommodate flood events up to or close to the 100-year event, as well as uncertainties related to sea level rise (page 4-40 in the Final EIS/EIR).

Response to Comment J-4

The new Pacific Way Bridge must be designed so that the elevation of the underside of the deck does not obstruct flood flows. An obstruction could cause water to back up, increasing the elevation of floodwaters upstream of the bridge. If a separate pedestrian bridge or boardwalk were built to cross the creek and floodplain, it would have to be as high as the new bridge to avoid creating an obstruction. It would be significantly more expensive and more visually intrusive to build a separate structure for a pedestrian crossing.

Consolidation of all modes of travel along the proposed Bridge Alternative BR4, rather than installation of additional boardwalk facilities, will maximize flood conveyance and minimize negative impacts on wetlands habitats.

The new trail between the Pacific Way bridge and the parking lot would be offset from the road by a 5 foot–wide buffer, and could also be grade-separated from the road by approximately 1 foot. This will enhance the aesthetic experience of the trail, but it will also prevent drivers from using the trail for roadside parking. From the Pacific Way bridge to Highway 1, the trail would be adjacent to the road.

Response to Comment J-5

No off-road recreational vehicles will be permitted on lagoon trails, beaches, and boardwalk areas, except emergency vehicles as necessary. The new emergency access route will be located from Pacific Way along the current access road to Green Gulch Farm to the southern project boundary. Bicycles will be permitted on the new trail from Highway 1 to the beach, as well as on the perimeter trail.

Response to Comment J-6

Public Access Alternative B4 includes a reconfigured parking lot to accommodate 175 cars rotated parallel to Pacific Way. The parking lot design does not currently accommodate a shuttle bus loading zone because there are no existing, feasible plans for such service to the parking lot. Bicycle parking areas will be provided at the parking lot.

Response to Comment J-7

Figure 2-15 (Public Access Alternative B4 Shown with Restoration Alternative 2) in the Final EIS/EIR indicates the general location of restrooms, interpretive displays, picnic areas, and trail entry to the beach. These would be located generally on the southwest corner of the parking lot, at the start of the boardwalk which leads to the beach. Design drawings will lay out the visitor facilities more specifically.

Response to Comment J-8

Trails, the beach, and boardwalks in the project area will continue to be multi-use areas. Disturbed areas during project construction would be replanted with native plants and maintained as part of ongoing maintenance and management efforts of the NPS.

Response to Comment J-9

Elevated boardwalks will be used for access over wetland areas, such as from the new parking lot to the beach.

Response to Comment J-10

Public Access Alternative B4 includes a reconfigured parking lot that increases the distance between the parking lot and the Redwood Creek bank while accommodating the same 175-cars capacity as the existing lot. An appropriate number of disabled parking spots will be provided. These features would be constructed and opened concurrently with the rest of the parking lot. The parking lot design does not currently accommodate a shuttle bus loading zone; no shuttle service to the beach exists or is currently planned. However, the parking lot can be modified in the future if needed to accommodate such a service.

Response to Comment J-11

This plan does not propose parking fees at the visitor parking lot.

Response to Comment J-12

During the preparation of design drawings, the NPS will consider how to create a few parking spaces outside the parking lot gate to accommodate residential users when the visitor parking lot is closed.

Response to Comment J-13

If public transportation opportunities become available and parking demand declines after project implementation, the NPS could take separate actions to reduce the size of the parking lot. Actions proposed in the Final EIS/EIR do not include public transportation.

Response to Comment J-14

Thank you for your comment. The NPS does not propose a trail adjacent to the creek in order to reduce impacts of human use on the natural habitat and its aquatic life, including three species named on the federal Endangered Species List. A trail along the meandering Redwood Creek alignment could cause erosion and sedimentation, create the need to route drainages through culverts, disturb wildlife, reduce habitat connectivity, and create a conduit for new invasions by non-native species. Such a trail would also be subject to flooding, creating long-term maintenance issues. Pedestrian access to the beach will be provided by the perimeter trail, as well as the trail from Highway 1 to the beach.

Response to Comment J-15

Thank you for your comment. The perimeter trail may include benches or passive observation areas, such as bird blinds. In addition, the new picnic area will provide new views of the ocean, as well as the adjacent wetland and riparian area.

Response to Comment J-16

Thank you for your comment. Interpretive displays are planned for topics such as the local ecology, the creek function, special status species, and cultural/tribal use, but interpretive displays will be designed and placed in a manner that is appropriate for the wild and rural setting.

National Park Service

Marin County Community Development Agency

Wetland and Creek Restoration at Big Lagoon, Muir Beach, Marin County

Record of Decision

November 2008

EXPERIENCE YOUR AMERICA™

The National Park Service cares for special places saved by the American people so that all may experience our heritage.

U. S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

RECORD OF DECISION

WETLAND AND CREEK RESTORATION AT BIG LAGOON, MUIR BEACH
FINAL ENVIRONMENTAL IMPACT STATEMENT

Golden Gate National Recreation Area
Marin County, California

INTRODUCTION

Pursuant to §102 (2) (c) of the National Environmental Policy Act of 1969 (P.L. 91-190, as amended), and the regulations promulgated by the Council on Environmental Quality (at 40 CFR 1505.2), the Department of Interior, National Park Service has prepared this Record of Decision regarding the Wetland and Creek Restoration at Big Lagoon Final Environmental Impact Statement / Environmental Impact Report (Final EIS/EIR) for Golden Gate National Recreation Area (GGNRA). Included is a description of background of the project, a statement of the decision made, synopses of other alternatives considered, a description of the environmentally preferred alternative, the basis for the decision, findings on impairment of park resources and values, measures to minimize or avoid environmental harm, and an overview of public involvement and agency consultation in the decision-making process.

DECISION (Selected Action)

The NPS will adopt and implement actions described as the Agency Preferred in the Final EIS/EIR (December 2007); this course of action combines elements of several alternatives. In addition, minor modifications are incorporated as a result of final consultation with partner agencies. The approved course of action is summarized as follows:

Area Restoration

Interim Flood Reduction Measures. Interim flood reduction measures consist of excavating the Redwood Creek channel from a maximum of about 400 feet upstream of the Pacific Way Bridge to about 100 feet downstream of the bridge. Actions may be performed once, or repeated on a more limited basis if needed. Interim actions will include removing log jams in the project area only if they are shown to be obstructing flood flows or contributing to sediment aggradation that is worsening flooding or the risk of channel avulsion. These measures will be performed during the interim period prior to implementation of the Restoration and Bridge Alternatives, which may not be completed until 2010 or 2011.

Relocation of Redwood Creek Channel. The Redwood Creek channel from the upstream project boundary to approximately 100 feet downstream of Pacific Way will generally be relocated to the topographically lowest portion of the valley; because this low point is very close to the Pelican Inn, the new channel will be located approximately 150 feet from the Pelican Inn driveway at Pacific Way. Most of the existing channel upstream of PacificWay will not be filled to create a backwater channel for use by salmonids and to increase flood storage capacity.

Construction of New Drainage Swale and Upper Pasture Modifications. A drainage swale will be constructed downstream of Pacific Way between the realigned creek channel and the eastern project boundary. Fencing around an equestrian ring on the southwestern side of the access road will be removed, and the area will be revegetated with seasonal wetland vegetation.

Backbeach Lagoon Enhancement, Channel Realignment, and Dune Restoration. Excavation will be done in the intermittently tidal lagoon along its landward side to expand its potential natural variation. Also, large woody debris (LWD) will be installed in the lagoon or at its edge to enhance habitat for juvenile steelhead and salmon. Finally, dune enhancement will occur through the possible natural lowering of the water table, combined with wind activity to develop dunes from newly dry (hence, erodible) sands. Fencing or other means will be used to restrict public access to dune restoration areas, and revegetation of native dune vegetation may be implemented to improve dune formation and quality. The removal of most fill shoreward of the parking lot where kikuyu grass occurs will be scraped about 1 foot deep, creating additional wetlands in the short-run and, possibly converting to dunes in the long-run with the build-up of wind-blown sand. Fill may be newly placed on a small portion of the area immediately adjacent to the reconfigured parking lot to function as a picnic area.

Removal of Levee Road. The 1,300 foot–long levee road will be removed to allow lateral channel migration and to reconnect Redwood Creek to the floodplain. An existing backwater channel will be lengthened to the northwest along the current route of the levee road. The area adjacent to this new backwater may be graded to an elevation slightly deeper than the existing grade to expand available floodplain habitat during base and peak winter flows.

Invasive Species Removal. Removal of invasive non-native plant species will occur both during the construction phase and throughout the project lifetime. In particular, Cape ivy, Himalayan blackberry, non-native invasive perennial grasses, such as kikuyu grass, Harding grass, and tall fescue, and other non-natives will be removed from various locations at the project site. Non-native species outside the project boundary that will be likely to spread to the project site will also be targeted for removal.

Removal of Tavern Remnants. Remnants of the Muir Beach Tavern between the parking lot and the mouth of Redwood Creek/inboard end of the tidal lagoon (southwest portion of the project site), will be removed including a buried retaining wall and concrete sidewalks. The tavern chimney will remain in place.

Removal and Relocation of Utility Lines. Removal and relocation of water, phone, and electric lines along the levee road and/or near Pacific Way will be done. Existing AT&T utility boxes will be relocated, and a decommissioned well pump adjacent to the levee road and associated above-ground power lines across Green Gulch pasture will be removed.

Removal of Concrete Channels and Revetment. Gabions and other channel armoring upstream of the existing footbridge will be removed to allow the restored channel to migrate more naturally. In addition, concrete channels along Green Gulch Creek and the unnamed tributary in the project area will be removed, as will concrete weir structure controlling flows between the existing emergent wetlands and Redwood Creek channel and the culvert from Green Gulch Creek under the levee road to Redwood Creek.

Modifications to Green Gulch Field 7. The windrow of Monterey cypress trees on the southwest edge of the field will be removed. Fencing around the perimeter of Field 7 will be adjusted to reflect the new project boundaries. An existing horse shelter will be relocated in the new boundary of Field 7.

Application of Traditional Ecological Knowledge. A traditional ecological knowledge study will be prepared in consultation with the Federated Indians of Graton Rancheria to compile and analyze the archaeological, ethnographic, and ethnohistoric data available to inform the restoration design, revegetation, and interpretation of the site.

Removal of Lower End of Existing Parking Lot and Picnic Area. The 90 feet at the southeast end of the existing parking lot, including the picnic area, to improve hydraulic conveyance of the creek will be removed. Minor parking lot modifications are described under the selected Public Access Approach and Minor Changes to the Selected Action.

Mosquito Management. Information will be provided to visitors and residents on how to reduce exposure to mosquitoes (e.g., wearing long sleeved shirts). Monitoring for larval mosquitoes will occur when surface water is present. Should numbers be present at levels sufficient to pose public health risks, the Park's IPM coordinator will treat ponded areas (using least-toxic controls). In the long term, colonization of the created wetland habitat by predatory insects should assist in reducing the risk posed by mosquitoes.

Public Access

Pedestrian Access from Hwy 1. A pedestrian trail, accessible by persons with disabilities, will be constructed along Pacific Way from Hwy 1 to the beach parking lot/drop-off. The portion of the trail closest to the parking lot will be separated from the road by up to about a 5 foot–wide buffer, and could also be grade-separated from the road by approximately 1 foot.

Pedestrian Access to Beach. The pedestrian boardwalk and bridge crossing from the new parking lot to the beach will be relocated to a location where its affects on channel function are minimized.

Interpretive Displays. Interpretive displays will be installed at the parking lot, and at the intersection of the Coastal Trail and Green Gulch Trail. In addition, an interpretive blind/overlook for bird watching could be constructed.

New Emergency Access Route. The existing road along the eastern edge of the site will be upgraded to serve as emergency access route from Pacific Way to the southern project boundary. This route will replace the levee road for access to the Coastal Trail and Coyote Ridge. The road will remain unpaved and the existing alignment will not be altered, but vegetation that has grown over the edges will be removed to extend width of the road to 11 feet to accommodate emergency access vehicles. A bridge crossing at the southern end of the Green Gulch pasture will be improved as necessary to facilitate vehicle passage.

Interpretation. Interpretive facilities will be provided during construction, including interpretive signage and possible kiosks located at strategic locations. Interpretation will also be an on-going activity at the site into the future.

Redwood Creek Restoration

The Creek Restoration Approach (Alternative 2) will relocate approximately 2,500 linear feet of Redwood Creek to the topographically lowest portion of the valley, while maintaining a habitat mix similar to current conditions. Creek relocation and restoration will be designed and graded to remove existing hydraulic constraints and minimize the need for ongoing maintenance. The new channel will include low sloping banks slightly higher than the adjacent floodplain to simulate the natural depositional levees that will occur in this reach. These low berms upstream of Pacific Way will accommodate bankful flows, maintain the low flow channel, and support riparian vegetation, thus increasing sediment transport and channel sustainability. Downstream of Pacific Way, the channel will be designed to accommodate more frequent out-of-bank flows of at least a 1-year frequency to create frequent floodplain habitat for salmonids. Most of the existing primary channel of Redwood Creek upstream of Pacific Way will not be backfilled in order to retain its function as backwater habitat. Several other backwater features

downstream of Pacific Way will also remain unfilled, and new backwaters will be excavated and connected to the new channel. The area adjacent to the backwaters will be graded to expand available floodplain habitat during base and peak winter flows.

Two areas will be excavated to create emergent wetland habitat. One emergent wetland area will be in the upper pasture, and the other emergent wetland area will be adjacent to the Green Gulch tributaries, but outside the boundaries of existing cattail habitat. The excavated wetland areas will have gradual slopes to provide suitable habitat conditions for the CRLF under the expected range of groundwater levels. The two tributaries from Green Gulch will be realigned and allowed to dissipate into the newly excavated wetland, mirroring historic conditions in which the Green Gulch drainage was not connected to the main channel. Concrete lining in the southern-most Green Gulch drainage channel will be removed (complete details are described in the Final EIS/EIR at p.2-16).

Public Parking: 175 Cars Rotated Parallel to PacificWay

The existing 175-car parking lot will be replaced by a 175-car parking lot that will be rotated parallel to Pacific Way (Alternative B4). The lot will include a new turn-off from Pacific Way and stacking room for cars between the entrance and the first parking stall. The distance of the parking lot from the creek bank would exceed 350 feet. The Selected Public Access Approach has been slightly modified, as described below.

Bridge Option: 250 Foot–Long Bridge with Highest Road

The Selected Option for a new Pacific Way Bridge is an approximately 250 foot–long bridge with a raised road at either end (Alternative BR4). This alternative would be the longest bridge, and would span the entire available riparian zone and floodplain from the Pelican Inn on the north to the existing bridge on the south. This bridge would have the highest deck of all the alternatives, between 16.25 and 18 feet NGVD, compared to the elevation of Hwy 1 at about 16.5 NGVD (i.e., the bridge would be between 0.25 feet lower and 1.5 feet higher than Hwy 1). For purposes of analysis, two foot–wide piers, placed at approximately 40-foot intervals, would be used to support the span and allow for channel migration.

MINOR CHANGES INCORPORATED INTO THE SELECTED ACTION

During ongoing formal Endangered Species Act (ESA) Section 7 consultation with the National Marine Fisheries Service (NMFS) following issuance of the Final EIS/EIR, GGNRA agreed to add conservation measures and design guidelines to the project to further reduce potential for impacts to federally listed salmonid species and their habitat. These changes are minor. Furthermore, they do not cause any new impacts not analyzed in the Final EIS/EIR. These modifications are described below along with an updated impact discussion for relevant impact topics where appropriate.

Preferred Public Access Alternative (B4): The parking lot design for Alternative B4 will be modified to be longer and narrower than the version shown on Figure 2-24 of the Final EIS/EIR. This change is required by NMFS to further reduce the parking lot's intrusion into the floodplain and obstruction to high flows and sediment transport. The outer lane (furthest from Pacific Way) of the parking lot shown on Figure 2-24 will be eliminated, including the parking spaces on either side of the lane. Parking spaces will be regained by elongating the parking lot. Instead of a rectangular design about 310 feet long and 230 feet wide, as shown on Figure 2-24, the parking lot would be longer and narrower, with final dimensions to be determined during the design phase. This modified version of the parking lot will occupy about the same square footage as the version shown on Figure 2-24. The location of the new entrance to the parking lot will be determined during final design. There will be no change in the parking capacity of the redesigned lot. The revised version will still have stacking room for vehicles

waiting for parking spaces, although the number of stacking spaces could be reduced by about 50% from 15 cars to about 7 or 8 cars. The new parking lot will have vegetated swales, and there will be a vegetated buffer zone between Pacific Way and the new portion of the parking lot. A picnic area and new restroom facilities will still be designed to occur adjacent to the parking lot, while also meeting criteria to maintain an outer rounded edge of the total footprint of the parking lot/picnic area. A new trail along Pacific Way will still be designed around the outer edge of the parking lot. These changes would result in minor impact changes to the following impact topics:

- Impact WP-P1: Greater than 100' stream setback depending on the final design of the parking lot and picnic area. This would incrementally improve the water flow conveyance and floodplain storage than described in the Final EIS.
- VEG-P3: This change will result in loss of 1.35 acres (originally estimated in Final EIS as 1.18 acres) of riparian habitat north of the existing parking lot along Pacific Way and .26 acres (originally estimated in Final EIS as .5 acres) of loss of the remainder of the parking lot and picnic area.
- VEG-P6: The Final EIS describes two pines lining Pacific Way being removed. This change may result in an additional two pines being removed from this area, although during final design these trees may be retained for aesthetic value.
- VEG-P8: The amount of jurisdictional wetlands may be reduced slightly, although the quantity of this reduction will not be known until final designs have been completed.
- REC-P2: Although it was originally estimated that the B4 parking lot would accommodate stacking space for 15 cars, this change may reduce the stacking space by up to half. However, during final design other traffic relief features will be considered.
- REC-P5: It is estimated that the stacking may be reduced by up to half that estimated in the Final EIS. Less stacking space may result in less patience by visitors who are waiting for a parking space to become available. Although the Final EIS estimates that overflow visitors impatient to wait for a parking space may result in visitors parking illegally in the Muir Beach community or Pelican Inn, the reduction in stacking space would only negligibly exacerbate this condition.
- TC-P7: Due to the loss of some stacking space, more cars may be queuing along Pacific Way during summer peak visitation season.

<u>Lagoon Water Surface Elevation (WSE)</u>: Seasonal spring and summer water surface elevations of the intermittent tidal lagoon will be managed during project implementation and for a subsequent period to be determined in consultation with NMFS. The water surface elevations of the lagoon will be managed after salmonid smolts have migrated out of the lagoon to the ocean in the spring. NMFS intends for this action to extend the seasonal duration and ponded water depth for good quality summer rearing habitat conditions for juvenile steelhead and coho salmon in the lagoon and the upstream reaches. To create these lagoon habitat conditions, native beach materials will be placed at the lagoon outlet to maintain a lagoon channel outlet that will not be easily breached. The exact timing of this action will be determined in consultation with NMFS and will be dependent on the seasonal geophysical processes contributing to lagoon formation.

<u>Construction Sequence of New Channel Alignment</u>: The portion of the new creek alignment through the Green Gulch pasture will be constructed two years in advance of fully diverting creek flows to it from the existing channel. When this creek reach is excavated, large and small woody debris will be placed in it, and a mixed palette of riparian vegetation will be planted. The purpose of this sequencing is to allow the new channel and its riparian cover to become established prior to abandoning the existing channel, thereby reducing potential impacts on salmonids. In the interim two-year period prior to full diversion of creek flows, this new reach would function as backwater habitat to the main channel. In addition, about 0.25 m of gravel and cobble will be placed in the new channel alignment upstream of Pacific Way. Native gravel will be used where possible. As is already planned, large woody debris will be incorporated into the new channel designs.

Elimination of Proposed Channel Relocation between the Footbridge and Tidal Lagoon: A 60-meter reach of Redwood Creek downstream of the beach footbridge had originally been proposed for relocation towards the beach, where it could become more mobile and responsive to changing conditions. However, due to the altered configuration of this reach after storm events in December 2005 and the substantial improvement in salmonid habitat conditions in this reach, it will not be relocated. This will eliminate the need to relocate salmonids in this reach during construction and maintain good habitat, thereby minimizing effects on salmonid populations during construction. The channel has already scoured into a subsurface sand layer, indicating it has already achieved the desired mobility.

Designs for Wetlands and Critical Habitat: Restoration designs will conform to federal guidelines and will specifically consider characteristics of substrates, organic matter, impervious soil layers, and groundwater interactions.

OTHER ALTERNATIVES CONSIDERED

No Action

Under the No Action Alternative, Redwood Creek would remain in its current alignment, and no large-scale physical modifications of the site would occur. Pacific Way road and bridge would remain unchanged in size and design and would continue to serve as the primary access route to the parking lot, which would also remain unchanged at its current location, as well as for residences along Pacific Way and Lagoon Drive. The No Action Alternative would allow for the continued periodic flooding of Pacific Way during storm events, resulting in the need for emergency intervention to prevent prolonged road closures. Periodic maintenance, including dredging, would continue to be needed to remove sediment and fallen trees from Redwood Creek, although its implementation would be hindered by the difficulty in obtaining permits from regulatory agencies for such actions. Channel avulsion of Redwood Creek (i.e., sudden relocation of the channel alignment during a large storm) would be likely under this alternative because the existing channel, in its confined condition, continues to aggraded (i.e., build up with sediment) in response to elevated sediment delivery from the watershed. Active seasonal management of the culvert and flashboards in the lower Green Gulch pasture would continue to be necessary to maintain ponded surface water for the CRLF.

Restoration Alternatives

In addition to the preferred Creek Restoration approach, two other restoration alternatives were analyzed:

- *Creek and Small Lagoon Restoration*: This restoration approach proposed to combine riparian restoration components with restoration of open water and wetland habitats. Specifically, two open-water lagoons would be created, one on either side of the new channel. The two small lagoons would be backwaters, connected to the creek near the downstream end of each lagoon. The banks of the lagoons would have varied slopes to favor a variety of habitats. The lagoons would maintain a minimum water depth of 3–4 feet year-round.
- *Large Lagoon Restoration*: This restoration approach proposed to create a periodically brackish open-water habitat similar to historic (1853) conditions, modified to reflect existing constraints of Pacific Way and private property. This approach would involve the creation of a large lagoon with fringing wetlands extending to the edge of the valley immediately landward of Muir Beach. The lagoon would be excavated with gentle side slopes to encourage colonization of emergent wetland vegetation. Like the small lagoons under Alternative 3, the large lagoon would maintain a minimum water depth of 3–4 feet year-round.

Public Access Alternatives

Public access alternative BR4 was the Selected Action. Other public access options considered were:

- *50 Cars at Beach* (Alt. B1) - . This alternative proposed to construct a 50-space parking lot at the beach at the site of the existing parking lot.
- *145 Cars at Beach* (Alt. B2) – This alternative proposed to retain the same footprint as the existing parking lot, but the lower 90 feet would be removed to accommodate a maximum of 145 vehicles.
- *175 Cars at Beach* (Alt. B3) – This alternative proposed to accommodate a maximum of 175 vehicles, the same number as the existing parking lot. The lot would be about the same size as the existing parking lot and would pulled back from the creek about 180 feet.
- *200 Cars at Beach* (Alt. B5) – This alternative proposed the largest parking lot of all the alternatives, with a maximum of 200 vehicle spaces.
- *118 Cars at Alder Grove plus 14 Disabled-Accessible* (Alt. C) – This alternative proposed a new parking lot would be constructed at Alder Grove along Hwy 1, north of Pacific Way. This parking lot would accommodate a maximum of 118 vehicles. Pedestrians would walk the 0.5 mile from the lot to the beach on a new trail through the alder grove that would be developed as part of this alternative. Additionally, an area within the footprint of the existing parking lot at the beach would accommodate 14 parking spaces for persons with disabilities and a drop-off/turnaround. The parking lot would be generally visible from Hwy 1 through a 25 foot–deep screen of trees.

Bridge Alternatives

The 250 ft. bridge alternative (Alt. BR4) was the Selected Action. Other options considered were:

- *50 foot–Long Bridge with a Raised Road* (Alt. BR1) – The shortest bridge alternative analyzed, this bridge alternative spans the 35 foot–wide channel with a deck at 16.5 feet NGVD. To provide vehicular access to the deck that would have a similar level of flood protection as the bridge, the elevation of the north and south approaches would be raised. At the lowest point of the road, the elevation gain would be up to about 5 feet to 15.5 feet NGVD. The bridge would be free-span and would not need supporting piers.
- *50 foot–Long Bridge with a Low-Road* (Alt. BR2) – This bridge alternative to BR1 but the deck height is lower at approximately 15 feet NGVD (similar to the existing bridge) and would not require extensive elevation changes for the approach. The bridge would be free-span and would not need supporting piers. The existing road on each side of the bridge would remain at its current elevation.
- *150 foot–Long Bridge with Raised Road* - (Alt. BR3) - This proposed bridge would be longer than Alternatives BR1 and BR2. It proposed to span both the new 35 foot–wide channel and areas of riparian habitat and floodplain on either side of the channel. The bridge span would provide for approximately the same available floodplain passage as the existing condition, which is currently defined by the area between the Pelican Inn fill pad and a fill pad for AT&T utility boxes, which together eliminate about 200 feet of floodplain width. For purposes of analysis, it is assumed that 2 foot–wide piers, placed at approximately 40-foot intervals, would be used to support the span and allow for channel migration. The bridge height would be about 16.25 NGVD. The road approach north and south of the bridge would be raised to a maximum of about 14.5 NGVD to provide a similar level of flood protection as the bridge. The raised road approach would begin at Hwy 1 and be about 2 feet higher than the current entrance to the Pelican Inn.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

As disclosed in the Final EIS/EIR, the “environmentally preferred” alternative is the combination of Restoration Alternative 2 (Creek Restoration), Public Access Alternative B4 (a 175-car parking lot at the beach rotated parallel to Pacific Way, with minor refinements as noted above), Bridge Alternative BR4 (a 250 foot–long bridge with a raised road at each end), disposal of fill materials at the Unused Reservoir, and composting of appropriate materials on NPS property at the Upper Banducci Field. Rationale for this determination are summarized as follows:

Restoration Alternative 2: This environmentally preferred approach achieves similar long-term benefits with respect to ecological value and visitor/resident experience; however, construction will have a smaller footprint, will be of shorter duration than either Restoration Alternatives 3 or 4, and would require less haulage of fill off-site. Less haulage of fill reduce impacts to the physical environment, biological resources, cultural resources, and social resources.

Public Access Alternative B4 and Bridge Alternative BR4: These environmentally preferred approaches have superior benefits related to long-term hydraulic and sediment transport processes, which have been determined to be more beneficial to the long-term protection of habitats at the site. Specifically, Public Access B4 has superior geophysical and long-term ecological benefits related to hydraulic capacity under large storm events, improved sediment transport to the beach and nearshore environment, and improved flood protection than the other access alternatives. It also does not have the same potential for reduced visitor experience, and community and traffic effects related to reduced parking lot capacity. It also avoids the adverse effects to aesthetics and biological resource of the larger lot and the remote lot. The environmentally preferred bridge alternative (BR4) has similar construction related effects as the other bridge alternatives; however, the longer span would reduce upstream flooding to the greatest extent and will allow the greatest level of all-weather access. In summary, BR4 and B4 in combination provide the greatest level of natural stream function by allowing adequate room for natural hydrological processes such as channel migration to reestablish, which in turn will improve salmonid habitat. This combination of project features (Restoration Alternative 2, Public Access Alternative B4, and Bridge Alternative BR4) is most consistent with the NPS mission, offers the best combination of project benefits, including factors related to both the project's purpose and need and its impacts.

MEASURES TO MINIMIZE HARM

This section summarizes the actions that will be implemented to minimize or lessen the impacts associated with implementing the project. Also summarized are terms and conditions imposed by agencies that have regulatory oversight of certain aspects or resources of the project. A full description of all the measures to minimize harm is attached (Attachment A: Measures to Minimize Harm).

Water Quality

- WQ-MM-1: Obtain Coverage Under the General Construction Permit and Implement Best Management Practices
- WQ-MM-2: Implement Spill Prevention and Control Plan
- WQ-MM-3: Implement Turbidity Monitoring and Response Plan
- WQ-MM-4: Implement Water Quality Monitoring and Response Plan

Air Quality

- AIR-MM-1: Implement All Applicable BAAQMD Dust Control Measures
- AIR-MM-2: Reduce NOx Emissions from Off- Road Diesel-Powered Equipment.
- AIR-MM-3: Limit the Daily Number of Fill Disposal Trips

Vegetation Communities

- VEG-MM-1: Conduct Follow-Up Weed Control and Revegetation Activities to Establish Appropriate Native Plant Species

Wildlife

- WLD-MM-1: Preconstruction Surveys and Possible Installation of Nest Boxes
- WLD-MM-2: Conduct Preconstruction Bird Surveys

- WLD-MM-3: Limit Construction Access Routes and Equipment Staging Areas and Conduct Preconstruction Surveys for CRLF in All Suitable Habitat That Will Be Disturbed by Construction
- WLD-MM-4: Augment CRLF Breeding Habitat
- WLD-MM-5: Implement Monitoring and Contingency Measures for CRLF
- WLD-MM-6: Reintroduce California Red-Legged Frog to Supplement Existing Population On Site
- WLD-MM-7: Implement Measures to Protect CRLF from Temporary Saltwater Intrusion
- WLD-MM-8: Implement Measures to Protect Bat Populations
- WLD-MM-9: Implement Measures to Prevent Increases in Corvid Populations

Fish

- FISH-MM-1: Riparian Shade Mitigation and Monitoring.
- FISH-MM-2: Optimization of Winter Rearing Habitat.
- FISH-MM-3: Avoidance and Monitoring of High Sound Pressure Levels during Pile-Driving Activities.

Cultural Resources

- CR-MM-1: Cultural Resources Education, Archaeological Monitoring, and Discovery Measures
    - Cultural Resources Education for Workers**:**
    - Archaeological Monitoring
    - Discovery of Archaeological Resources During Construction
- CR-MM-2: Educate the Workers Conducting the Harding Grass Removal and Have an Archaeological Monitor in the Vicinity of the Fan Site
- CR-MM-3: Limit Compaction Methods Above the Recorded Deposit; Consult with NPS, the County, and FIGR; and Clarify Site Disposition During the Design Process

Recreation

- REC-MM-1: Construction Exclusion Areas
- REC-MM-2: Horse and Equestrian Safety Measures

Traffic Control

- TC-MM-1: Construction Traffic Management Plan
    - Develop and Implement a Traffic Control Plan

Public Safety and Human Health

- PS-MM-1: Employ Sustainable Construction Practices
- PS-MM-2: Maintain Utility Services
- HS-MM-1: Stop Work and Implement Hazardous Materials Investigation/Remediation

Noise

- NZ-MM-1: Employ Noise-Reducing Construction Practices
- NZ-MM-2: Prepare a Noise Control Plan
- NZ-MM-3: Disseminate Essential Information to Residences and Implement a Complaint/Response Tracking Program

PUBLIC INVOLVEMENT AND AGENCY COORDINATION

Described below were the primary opportunities for the public to review and comment on the project. Overall the conservation planning effort complied with both NEPA and California Environmental Quality Act (CEQA) for public involvement, including: project scoping, preliminary drafting of alternatives and mitigation strategies, public review of environmental documents, and public hearings.

Project Scoping: The scoping process was formally initiated under NEPA on December 3, 2002 with the publication of a Notice of Intent in the Federal Register. The Notice identified goals for the project, and public scoping meetings were held on October 22, October 29, and November 2, 2002, with a site visit for the public held on November 9, 2002, to solicit input on the project and its potential impacts. Comments were provided by a number of agencies, organizations, and members of the public.

Between December 2002 and December 2004, 17 public meetings were held, as well as a variety of site visits and meetings with representatives of various agencies. Following these meetings, a Big Lagoon Working Group consisting of interested individuals, agencies, and organizations was formed to help develop project alternatives. The working group convened regularly in meetings that were open to the public. In addition, two alternatives workshops were held for the public on September 30 and October 4, 2003. The results of those workshops, as well as a more detailed summary of the scoping process, are presented in an Alternatives Public Workshops Report prepared in 2004.

During scoping, interested parties included local Muir Beach residents, local/state/federal environmental and regulatory agencies, and Green Gulch Farm. The issues brought up most consistently by local residents regarded the need to reduce flooding to their homes, but also the desire for the project to retain area's natural beauty and environmental qualities. Environmental organizations and regulatory agencies expressed concerned that the project does not harm biological assets and physical processes of the area, including three federally listed species.

Public Review of the Draft EIS/EIR: The Draft EIS was also released as an Environmental Impact Report (EIR) for compliance under CEQA, and the combined document is referred to as a Draft EIS/EIR. The Draft EIS/EIR was circulated to local, state, and federal agencies and to interested organizations and individuals to review and comment on the report. Proactive public outreach included notices in local newspapers, over 4,000 notification flyers to the GGNRA mailing list, a press release (and local media coverage), and posting on the park's website. Over 100 paper copies were delivered to interested public, organizations and local libraries, and regulatory agencies. The opportunity for public review extended for a 75-day period, beginning on December 22, 2006, the date of EPA's notice of filing published in the Federal Register (the NPS's Notice of Availability was published on December 18). Twenty-six (26) people commented on the Draft EIS.

Following release of the Draft EIS/EIR, NPS and Marin County hosted public meetings on January 18 and 31, 2007 to present the project to interested parties and respond to questions. The meetings were well attended with close to 100 people attending. NPS and Marin County also conducted a public hearing at the Marin County Planning Commission in San Rafael, California, on February 26, 2007, to receive comments on the draft document. An interagency meeting was also held on February 17, 2007 to review the Draft EIS/EIR. On August 3, 2007 the EPA formally announced their favorable "LO" rating of the Draft EIS in the Federal Register, endorsing the initiative to restore ecosystem functions and values.

Public Release of the Final EIS/EIR: Over 100 copies of the Final EIS/EIR were distributed to federal, state, and local agencies and to interested groups and individuals. Public outreach included public notices in local newspapers, over 4,000 notification flyers to the GGNRA mailing list, a press release, and posting on the park's website. Pursuant to NEPA, the "no action" 30 days waiting period was initiated with the EPA's notice of filing published in the Federal Register on December 21, 2007 (the NPS's

Notice of Availability was published on December 20). Consistent with County environmental review procedures, also beginning on the date of EPA's notice, the Final EIS/EIR was circulated for a 45-day period concluding on February 4, 2008. Following release of the Final EIS/EIR, the NPS and the County held one public meeting to present the project to interested parties and to answer questions about the project. This meeting was held on January 22, 2008 at the Bay Model in Sausalito, CA. Approximately 20 people attended the public meeting. A total of 10 comment letters were received on the Final EIS/EIR. Consistent with County environmental review procedures, comments on the Final EIS/EIR (and responses) are hereby adopted as an Amendment to the Final EIS/EIR.

Additional public review and comment occurred during the CEQA lead agency's (Marin County) certification process. This process includes the county's Planning Commission making a recommendation to the County Board of Supervisors to certify the EIR as adequate and complete in compliance with CEQA. On March 24, 2008 Marin County Planning Commission conducted a public meeting and voted without objection to recommend that the Board of Supervisors certify the Final EIS/EIR. On May 13, 2008 the Marin County Board of Supervisors conducted a public meeting to consider certification of the Final EIS and to receive testimony on the adequacy of the Final EIS/EIR for certification. On this same date the Marin County Board of Supervisors certified the Final EIS/EIR (Resolution 2008-53) with a unanimous vote.

AGENCY CONSULTS AND COMPLIANCE STATUS

The following describes the project's compliance status with relevant federal and state laws, regulations, and executive orders.

Endangered Species Act of 1973 As Amended (PL 93-205, 87 Stat. 884, 16 USC §1531 et seq.)
Species occurring on the project site that are listed as threatened under the federal ESA include coho salmon, steelhead, and California red-legged frog. One other listed species has been observed at the project site, California brown pelican (federally endangered). The NPS has engaged in informal and formal consultation with the USFWS and NMFS throughout in the project planning process. Upon request, the USFWS sent the NPS a species list for the Big Lagoon site. NMFS sent a list of threatened and endangered fish under its jurisdiction that may be affected by the project. These lists include plant and animal species that may occur within, or be affected by activities within, the project area. A summary of consultation by agency is as follows:

USFWS: As part of Formal Consultation with the USFWS, NPS sent a Biological Assessment (BA) to the USFWS On December 11, 2007. Based on the BA, on February 5, 2008 the USFWS issued a Biological Opinion (BO) to the NPS. In the BO, USFWS concurred with NPS's determination that the project is not likely to adversely affect or have no effect on the threatened west coast population of the western snowy plover (*Charadrius alexandrinus nivosus*), threatened northern spotted owl (*Strix occidentalis caurina*), endangered tidewater goby (*Eucyclogobius newberryi*), endangered California freshwater shrinp (*Syncaris pacifica*), endangered Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*), endangered California brown pelican (*Pelcanus occidentalis californicus*), endangered Sonoma alopercurus (*Alopecurus aequalis var. sonomensis*), endangered beach layia (*Layia carnosa*), endangered clover lupine (*Lupinus tidestromii*), and the endangered Sonoma spineflower (*Chorizanthe valida*) due to the avoidance measures that will be implemented as part of the project, their biology and ecology, and/or a lack of suitable habitat for these listed species in the action area. Although the BO concurred that the project is not likely to jeopardize the continued existence of this species, because excavation and earthmoving activities associated with the project have the potential to kill or injure the California red-legged frogs, the BO authorized Incidental Take in the form of death or injury of one individual and harm, capture and harassment of all California red-legged frogs inhabiting the site The BO outlines non-discretionary actions the NPS must perform to minimize the potential for harm, harassment, injury, or

mortality of the California red-legged frog. These actions are described above in the "Measures to Minimize Harm" section.

NMFS: As part of Formal Consultation, NPS sent a Biological Assessment (BA) to NMFS in February 2008. During formal consultation NMFS requested that the NPS incorporate modifications to the project actions. These actions are detailed above in the section titled, "Minor Changes to the Selected Action". Based on the BA, on October 15, 2008 the NMFS issued a Biological Opinion (BO) to the NPS. In the BO, NMFS concluded that the project is not likely to jeopardize the continued existence of listed salmonid species or adversely modify designated critical habitat. However, NMFS anticipates take of listed salmonid species to occur as a result of project implementation. Because take of listed species is expected to occur, NMFS included an incidental take statement in their BO. The BO outlines non-discretionary actions the NPS must perform to minimize the potential for harm, harassment, injury, or mortality of endangered Central California Coast coho salmon (*Oncorhynchus kisutch)* and threatened Central California Coast steelhead (*Oncorhynchus mykiss)*. These actions are described above in the "Measures to Minimize Harm" section.

The Magnuson-Stevens Fishery Conservation and Management Act As Amended by the Sustainable Fisheries Act of 1996 (PL 104-267)

The NPS consulted with NMFS on all proposed actions permitted, funded, or undertaken by the agency that may adversely affect Essential Fish Habitat (EFH). NMFS provided recommendations to conserve EFH for activities that would adversely affect EFH. Redwood Creek is designated as EFH for coho salmon (*Oncorhynchus kisutch)*. NMFS, in their October 15, 2008 Biological Opinion concluded that the project will only result in temporary or minimal adverse effects to EFH, and thus provided no EFH conservation recommendations.

Section 404 of the Clean Water Act (33 USC 1344) and Section 10 of the Rivers and Harbors Act of 1899 33 USC 403)

All proposed work and/or structures extending bayward or seaward of the line on shore reached by (1) mean high water in tidal water, or (2) ordinary high water in nontidal waters designated as navigable water of the United States must be authorized by USACE pursuant to §10 of the Rivers and Harbors Act. §404 of the Clean Water Act regulates discharge of dredged and fill material into waters of the United States, including wetlands. In May 2006 NPS submitted a revised jurisidictional delineation to USACE, and the delineation was confirmed by the USACE in March 2008. A permit application was submitted to USACE in February 2008 that outlined activities that would discharge into waters of the U.S. Authorizing a permit is considered a discretionary action subject to NEPA, as such the USACE solicited public review and comment on the proposed permit actions. Under §401 of the Clean Water Act, the 404 permit must be Certified by the California State Regional Water Quality Review Board. Both the USACE and the RWQCB are supportive of this restoration project, and have committed to finalizing the permitting process after more detailed construction drawings have been completed post ROD.

Archeological Resources Protection Act of 1979 (PL96-95, 93 Stat. 712, 16 USC §470aa et seq. and 43CFR 7, subparts A and B, 36 CFR)

This act secures the protection of archeological resources on public or American Indian lands and fosters increased cooperation and exchange of information among the private, government, and professional community in order to facilitate the enforcement and education of present and future generations. It regulates excavation and collection on public and American Indian lands, and requires notification of American Indian tribes who may consider a site of religious or cultural importance prior to issuing a permit. The NPS will meet its obligations under this act in all activities undertaken as part of the Big Lagoon restoration project.

National Historic Preservation Act of 1966 As Amended (PL 89-665, 80 Stat. 915, 16 USC §470 et seq. and 36 CFR 18, 60, 61, 63, 68, 79, 800) 36 CFR 800 is the set of regulations through which Section 106 is implemented.
§106 of the National Historic Preservation Act requires that agencies evaluate potentially historic properties for their eligibility for listing in the National Register of Historic Places and take into account the effects of the undertakings on properties listed in or eligible for listing in the National Register of Historic Places. For the proposed undertaking, in a February 25, 2007 NPS letter sent to SHPO, NPS made a determination that the project will not have an adverse affect on historic properties. In a letter dated April 2, 2008 from SHPO to the NPS, SHPO concurred with NPS's determination.

Native American Graves Protection and Repatriation Act Compliance
The Native American Graves Protection and Repatriation Act (NAGPRA) specifies the procedures that federal agencies must follow when burials of Native American origin are found on federal land (43 CFR, Part 10, Subpart B, Section 10.4). GGNRA has responsibility for complying with NAGPRA for the entire area of potential effect (APE). If human remains of Native American origin are discovered within the APE during archaeological excavation or during construction-related ground disturbing activities, the following provisions will be carefully observed: a) Notify, in writing, the responsible federal agency, and Cease activity in the area of discovery and protect the human remains. Upon notification that human remains have been discovered on federal land, NAGPRA requires that GGNRA will; b) Certify receipt of the notification; c) Take steps to secure and protect the remains; d) Notify the Native American tribes or tribes likely to be culturally affiliated with the discovered human remains within 1 working day; and e) Initiate consultation with the Native American tribe or tribes in accordance with regulations described in 43 CFR, Part 10, Subpart B, Section 10.5. If Native American human remains are encountered during excavation in the APE, work in the vicinity of the remains will halt immediately. The ultimate disposition of the remains will be determined in consultation with Native American representatives.

Executive Order 11988: Floodplain Management
Federal agencies must avoid, to the extent possible, adverse impacts associated with the occupancy and modification of floodplains, and will avoid development in floodplains whenever there is a practical alternative. All actions evaluated in the Final EIS/EIR are consistent with this executive order.

Executive Order 11990: Protection of Wetlands
This executive order established protection of wetlands and riparian systems as the official policy of the federal government. It requires all federal agencies to consider wetland protection as an important part of their policies; to take action to minimize the destruction, loss, or degradation of wetlands; and to preserve and enhance the natural and beneficial values of wetlands. All applicable actions evaluated in the Final EIS/EIR are consistent with this executive order.

Executive Order 13112: Invasive Species
This executive order proscribes the introduction of invasive species and directs federal agencies to not authorize, fund, or carry out actions that are likely to cause or promote the introduction or spread of invasive species. Actions evaluated in the Final EIS/EIR include measures to prevent introduction and spread of invasive species.

California Coastal Zone Management Act
This act protects coastal environments. While the act transferred regulatory authority to the states and excluded federal installations from the definition of the "coastal zone," it requires that federal actions be consistent with state coastal management plans. Activities taking place within the coastal zone under the definition established by the California Coastal Management Plan require a federal consistency determination. A Consistency Determination (CD) was submitted to the California Coastal Commission in March 2008 for consideration and approval at the Commission's hearing held in Marina Del Rey, California in May 2008. The Commission's Board approved the CD without stipulation on May 9, 2008.

IMPAIRMENT FINDINGS

The NPS has determined that implementation of the Selected Actions described herein will not constitute impairment to park resources and values. This conclusion is based on a thorough analysis of the environmental impacts described in the Final EIS/EIR, with due consideration for the public comments received and applicability of relevant scientific studies, and the professional judgment of the decision-maker guided by the direction in the NPS Management Policies (NPS 2006). Based on analyses in the Final EIS/EIR, all uses that may occur in the park as a result of implementing the Selected Actions are appropriate, and none of the foreseeable impacts are unacceptable. While the project may have some adverse impacts, in most cases, these adverse impacts are no more than moderate. In those cases where impacts are major, they are associated with construction and are temporary in nature and mitigation measures were developed to minimize impact. Overall, the project results in major benefits to park resources and values and would not lead to their impairment. While the plan has described adverse impacts, in all cases these impacts are related to actions that are necessary to preserve and restore park resources and values. Overall, the Selected Actions results in major benefits to park resources and values and it does not result in their impairment.

BASIS FOR DECISION

The decision to implement the Selected Action was based on careful consideration of the alternatives presented, the foreseeable environmental impacts, project's goals and objectives, and public comments received throughout the planning process. The Selected Action best accomplishes NPS policies, the legislated purpose of GGNRA, and the statutory mission of the NPS to provide long-term protection of park resources. The selected action best accomplishes the stated purpose of the project, and best addresses the purpose and conditions of need described in the EIS/EIR.

Consistency with Agency Policy and Land Management Plans

This project has two lead agency sponsors—the County of Marin (California) and NPS. Although it is a joint project, the County and NPS each will play a unique role in the project. The County's role is limited to actions related to improvements to Pacific Way and the Pacific Way Bridge. All other actions are the responsibility of NPS. All components of the project are related and necessary to achieve the overall goals and objectives of the project; for this reason, they have been included as the whole of the project. GGNRA. For both lead agencies the project was analyzed for consistency with their respective land management plans. For NPS, the General Management Plan (GMP) provides the foundation and framework for the management and use of lands and articulates the desired conditions for natural and cultural resources and visitor experiences to best fulfill the park's purpose.

This decision does not constrain nor condition non-NPS actions (a separate CEQA decision will be prepared). However, for Marin County, land use on the portions of the project site not owned by NPS is guided by the County's General Plan, the Marin Countywide Plan (Countywide Plan). Analysis in the Final EIS/EIR found that the selected action is consistent with both lead agencies' land management plans. Furthermore, the Final EIS/EIR analysis conducted a consistency review of NPS's management policies (2006) and found that the selected action is consistent with these policies.

Purpose and Need / Goals and Objectives

The purpose and need for the project is to restore a functional, self-sustaining ecosystem, including wetland, riparian, and aquatic components and to conduct the restoration in a manner that will re-create habitat for sustainable populations of special-status species, reduce flooding on Pacific Way, and provide a compatible visitor experience. The Selected Action promotes a high level of protection of life and property, and greater long- and short-term natural and cultural resource benefits than other alternatives considered. In combination, the selected actions will:

- Restore a functional, self-sustaining ecosystem to the maximum extent of any of the alternatives.
- Support sustainable populations of existing special status species.
- Ensure improved vehicle access for the Muir Beach community.
- Provide a visitor experience that is compatible with ecosystem restoration and historic preservation.
- Have a relatively small construction footprint, relatively short construction duration, and will minimize construction-related impacts such as dust, noise, and the need to haul and dispose of fill.

CONCLUSION

As documented in the Final EIS/EIR, the following key factors support implementation of the Selected Action:

- the environmental impact analyses demonstrate that the Selected Action will have short-term impacts but will ultimately secure long-term benefits for GGNRA's resources;
- the Selected Action will have a high likelihood of achieving the expressed purpose, need, goals and objectives;
- the Selected Action is fully compliant with NPS's mission and policies, GGNRA's management plans, and other pertinent laws and regulations;
- the Selected Action specifies all feasible and prudent measures to minimize environmental harm;
- the Selected Action is a reasonable and rational effort supported by park partners, researchers, local communities, other government regulatory agencies, and environmental organizations; and
- undertaking the Selected Action will not result in impairment of park resources and values.

I hereby approve the Selected Action for implementation by Golden Gate National Recreation Area.

Approved:

Jonathan B. Jarvis, Regional Director
Pacific West Region, National Park Service

11/25/08
Date

Attachment A

Measures to Minimize Harm

Water Quality	
WQ-MM-1	*Obtain Coverage Under the General Construction Permit and Implement Best Management Practices* Prior to onset of construction activities, NPS, the County, and/or its contractors will obtain coverage under the NPDES General Construction Permit. As part of this process, a SWPPP will be prepared and BMPs identified in the SWPPP will be implemented to control soil erosion, in-channel turbidity, and discharges of other construction-related contaminants such as fuel, oil, grease, paint, concrete, and other hazardous materials. Routine monitoring and inspection of BMPs will be conducted to ensure that the quality of stormwater discharges is in compliance with the permit. Flows in the creek or wetland areas will be diverted around the active construction area, and ground-disturbing activities will be limited to the dry weather season to the extent possible. The SWPPP will be prepared prior to the start of construction activities and prescribe site-specific implementation of BMPs to avoid and reduce waste discharges. The SWPPP will include BMPs that address the following general categories of erosion and runoff control: ▪ conduct construction activities during the dry season to the extent possible; ▪ conduct all construction work in accordance with site specific construction plans that minimize the potential for increased delivery of sediment to surface waters; ▪ tracking control measures to reduce sediments that leave the construction site on vehicle or equipment tires; ▪ cover all loads to reduce the potential for loss of materials during transit; ▪ ensure that concentrated runoff and concentrated discharge are diverted away from channel banks; ▪ minimize removal of and damage to native vegetation; ▪ install temporary construction fencing to identify all areas that require clearing, grading, revegetation, or recontouring, and minimize the extent of areas to be cleared, graded, recontoured, or otherwise disturbed; ▪ grade and stabilize or cover spoils sites to minimize erosion and sediment input to surface waters and generation of fugitive dust; routinely water dust-prone construction areas to reduce generation of fugitive dust and to control migration of sediment outside of the project area on construction vehicle tread; ▪ as appropriate, implement erosion and sediment control measures to prevent sediment from entering surface waters, including the use of willow wattles to trap sediments and erosion control blankets on slopes and channel banks; ▪ avoid operating equipment in flowing water by using temporary cofferdams and water diversion systems to divert flow around the channel and bank construction area; and monitor water quality of dewatering operations and hazardous material delivery, storage, and emergency spill response requirements. As a performance standard, the BMPs shall represent the best available technology that is economically achievable and shall be selected to achieve maximum sediment removal. The contractor will select specific BMPs from each area, with NPS/County approval, on a

	site-specific basis. The construction contractor will ensure that the BMPs are implemented as appropriate throughout the duration of construction and will be responsible for subcontractor compliance with the SWPPP requirements. In the case of ground-disturbing activities that are of less than one acre in extent (e.g., possibly the routine maintenance dredging activities), coverage under the General Construction Permit will not be required, but NPS, the County and/or its contractors shall still be required to adhere to the BMPs and standards identified above.
WQ-MM-2	*Implement Spill Prevention and Control Plan* As part of the obtaining coverage under the NPDES General Construction Permit, the NPS and/or its contractors will develop and implement a spill prevention and control program to minimize the potential for, and effects from, spills of hazardous, toxic, or petroleum substances during construction of the project. The plan will be completed before any construction activities begin and shall include provisions for preventing, containing, and reporting spills of hazardous materials. If a spill is reportable, the contractor's superintendent would notify the Marin County Department of Emergency Services and the California Department of Toxic Substances Control (DTSC).
WQ-MM-3	*Implement Turbidity Monitoring and Response Plan* NPS or its contractors will develop and implement a plan to monitor turbidity resulting from the restoration project. This will involve review of existing monitoring data and collection of turbidity measurements within the project site prior to the restoration activity, both during and immediately following storm events as well as during the dry season, to establish background turbidity levels. Following construction of the project, turbidity monitoring will be conducted as outlined above for up to 5 years, or until monitoring results indicate that turbidity has returned to background levels. Should elevated turbidity persist after the first three years following construction, specific areas on the restored site that are contributing to elevated sediment inputs will be identified, and these locations will be repaired by installing erosion control BMPs. As a performance standard, the BMPs shall represent the best available technology that is economically achievable and shall be selected to achieve maximum sediment removal.
WQ-MM-4	*Implement Water Quality Monitoring and Response Plan* NPS or its contractors will develop and implement a plan to monitor water quality resulting from the restoration project. Previously collected water quality measurements within the project site and upstream in the watershed will be used as the basis for baseline conditions. Similar sampling methodologies will be implemented after project construction, such as collection of samples immediately following storm events and during the dry season. Parameters to be evaluated will include, at a minimum, temperature, pH, DO, total dissolved solids/electrical conductivity, total suspended solids, nutrients, and bacteria. On the basis of this sampling, water quality conditions will be evaluated to determine whether applicable water quality standards have been exceeded or beneficial uses have been impaired for a sustained period (i.e., greater than 2 years) as a result of the restoration project, such as through excessive nuisance plant growth in the restored lagoons resulting in alterations of water temperature, low DO levels, and excessive nutrient levels. Hydrologic conditions and nutrient cycling at the project site will differ from existing conditions and thus require time to adjust to a new naturally functioning condition. Consequently, the thresholds may change to reflect different stages of project establishment. Violations of water quality standards or impairments of

	beneficial uses as a result of the project shall be ameliorated through implementation of BMPs or other adaptive management actions as needed. Should long-term monitoring (greater than 5 years of consecutive data) indicate that the project is not having an adverse effect on water quality, monitoring may be ceased.
Air Quality	
AIR-MM-1	*Implement All Applicable BAAQMD Dust Control Measures* NPS shall implement all feasible and practicable control measures for construction emissions of PM10 as required by BAAQMD (Bay Area Air Quality Management District 1999). These control measures are summarized in Table 4.3.1.4-20 in the Final EIS.
AIR-MM-2	*Reduce NOx Emissions from Off- Road Diesel-Powered Equipment.* The project shall prepare and implement provide a plan, for approval by the lead agency and BAAQMD, a plan demonstrating that the heavy-duty (> 50 horsepower) off-road vehicles to be used in the construction project (including owned, leased, and subcontractor vehicles) will achieve a project-wide fleet average 20 percent NOx reduction and 45% particulate reduction compared to the most recent ARB fleet average at time of construction. Acceptable options for reducing emissions may include, but are not limited to: ▪ use of late model engines, ▪ low-emission diesel products, ▪ alternative fuels (e.g., aqueous diesel fuel), ▪ engine retrofit technology (e.g., diesel particulate filters, diesel oxidationcatalysts, lean-NOx catalysts), after-treatment products, and/or ▪ other options as they become available.
AIR-MM-3	*Limit the Daily Number of Fill Disposal Trips* Total PM10 emissions shall be maintained below the 80 ppd standard. One method for achieving this would be to limit the number of fill disposal trips to 46 round-trips per day (based on 10-CY trucks).
Vegetation Communities	
VEG-MM-1	*Conduct Follow-Up Weed Control and Revegetation Activities to Establish Appropriate Native Plant Species.* Prior to placing fill in any of the proposed locations, NPS will prepare a weed control and revegetation plan appropriate for the particular fill site to avoid establishing new populations of weeds that threaten native habitats. The plan will identify specific target species for control and methods of control. The plan will also identify appropriate native species to be revegetated onto the fill site and propagules to be used, such as either nursery-grown plant stock or native seed.
Wildlife	
WLD-MM-1	*Preconstruction Surveys and Possible Installation of Nest Boxes* Before riparian areas are cleared, a count of mature trees with available cavities should be

	taken to roughly estimate the number of cavities being lost. If the survey and an analysis by a qualified individual demonstrates that inadequate habitat remains for cavity nesters, nest boxes will be erected to match, as closely as possible, the lost value. Should the findings of the surveys result in the conclusion that nest boxes are not necessary, this mitigation measure would not be needed.
WLD-MM-2	*Conduct Preconstruction Bird Surveys* Any vegetation (i.e., trees, shrub, grasses) that is not removed within the timing window specified in the GGNRA Standard Operating Procedures for vegetation cutting and removal will be surveyed for active bird nest(s) prior to its removal inside of the nesting period. This will include all vegetation to be disturbed and any areas that will be used to access the site or stage equipment. If active nests are found, no restoration related activities will occur within 50 feet of the nest while it is active.
WLD-MM-3	*Limit Construction Access Routes and Equipment Staging Areas and Conduct Preconstruction Surveys for CRLF in All Suitable Habitat That Will Be Disturbed by Construction* Construction access routes and equipment staging areas will be limited within the study area to the extent feasible. These access routes and all other areas to be disturbed by restoration activities will be surveyed for the presence of CRLF prior to the beginning of construction activities. These preconstruction surveys will be conducted within 48 hours of the beginning of ground disturbance and will be planned with a “one step ahead” approach relative to construction activities. All rodent burrows, leaf litter deeper than 2 inches, or other obvious refugia will be surveyed for the presence of the species. Once it is determined that no individuals are present, exclusion fencing will be erected and maintained around the construction areas to prevent CRLF from entering into the active construction area. The exclusion fence will be about 3.5 feet high and keyed into the subsurface about 6 inches deep. Exclusion fences used around existing frog habitat will be fitted with intermittent one-way entry devices to allow frogs to enter, but not exit, the protected area. These fences will be walked every morning to ensure that no frogs have become “stuck” or entangled during nighttime movements and all amphibians observed during these morning checks will be relocated to the nearest suitable aquatic habitat outside of the construction area. Any CRLF discovered will be relocated at least 1,000 feet from the area of disturbance and released into suitable aquatic habitat by a biologist permitted under the Endangered Species Act Section 10(a)(1)(A).
WLD-MM-4	*Augment CRLF Breeding Habitat* New emergent wetlands will be excavated to provide additional breeding habitat for CRLF. These wetlands will be sized and designed such that they can support a long-term, persistent population of CRLF. Under the action alternatives, since CRLF habitat would already be provided onsite, this additional pond would be provided upstream at the Banducci site prior to construction, and would be supported by groundwater and designed to facilitate successful CRLF breeding. Construction of this new 0.52-acre pond was completed at the Banducci Site in October 2007, and revegetation with native wetland species is currently underway. Reintroduction of CRLF to the Banducci site will be carried out in coordination with USFWS to reestablish a viable breeding population at the Banducci site. Individuals will be relocated from a well-established population in an

	adjacent watershed, rather than from the local population, since it is so small. A strategy will be designed and implemented to ensure that the donor population is not adversely affected, the regional genetic integrity of CRLF is maintained, and that the newly established populations have the best chance to succeed.
WLD-MM-5	*Implement Monitoring and Contingency Measures for CRLF* CRLF populations and habitat conditions (duration of inundation at breeding site and cover) will be monitored at the Big Lagoon site on an ongoing (annual) basis. CRLF habitat will be monitored for both predators (fish) and to confirm that the existing habitat is occupied by CRLF and/or new habitat is colonized by CRLF. The GGNRA will work with the San Francisco Zen Center to remove all nonnative fish from their lands and within NPS lands. Should fewer than two CRLF be sighted in two consecutive years following construction, NPS will implement WLD-MM-6.
WLD-MM-6	*Reintroduce California Red-Legged Frog to Supplement Existing Population On Site* Reintroduction of CRLF will be undertaken in coordination with USFWS to reestablish a viable breeding population on the Big Lagoon site. Individuals will be relocated from a well-established population in nearby watersheds. A strategy will be designed and implemented to ensure that the donor population is not adversely affected, the regional genetic integrity of CRLF is maintained, and that the newly established populations have the best chance to succeed.
WLD-MM-7	*Implement Measures to Protect CRLF from Temporary Saltwater Intrusion* Restoration Alternatives 3 and 4 will be designed to provide areas of upland refuge from saltwater intrusion into aquatic environments. These areas will have low shrub or tree cover sufficient to maintain cool damp soils and leaf litter during all seasons. Established riparian areas can provide this function if such areas are already present adjacent to potential CRLF breeding pools.
WLD-MM-8	*Implement Measures to Protect Bat Populations* Preconstruction surveys for bat species will be conducted in areas of suitable habitat within the project area. For tree-roosting bats, all potential roost trees that must be removed will be surveyed and identified in the field, and the following procedures will be applied prior to felling: (1) trees will be removed under the warmest possible conditions practical, (2) sections of the exfoliating bark will be peeled off the tree gently to search for any roosting bats underneath, (3) noise and vibrations (e.g., striking the tree base) will be created on the tree itself. When cutting sections of the bole, if any hollows or cavities (such as woodpecker holes) are discovered, a biologist will carefully check for the presence of bats in those areas.
WLD-MM-9	*Implement Measures to Prevent Increases in Corvid Populations* The site will be supplied with enough trash receptacles to serve average visitor numbers depending on the time of year. Receptacles will be wildlife proof with lids that will default to a closed position. Trash collection will be done at a rate commensurate with the number of visitors in the area. Signage will be placed to educate visitors regarding the

	effect litter can have to wildlife, particularly in a sensitive coastal ecosystem such as Big Lagoon.
Fish	
FISH-MM-1	*Riparian Shade Mitigation and Monitoring.* Water temperatures will be monitored at the site through Year 5, postconstruction, to ensure that they remain within the range of acceptable conditions for fish. Should temperatures be found to be outside the acceptable range for fish, NPS may use temporary, artificial means of shading during summer months while riparian vegetation matures. For example, long willow stakes may be tied together to create "rafts" that float on the water surface, thus creating shade and cool pockets of water. The rafts will appear natural and wash downstream on their own, and no on-site management of artificial materials will be needed. Additionally, riparian shade transects will be established to monitor and assess the recovery of riparian vegetation and the shade they provide.
FISH-MM-2	*Optimization of Winter Rearing Habitat.* Regardless of which alternative is selected, during the process of design, NPS will ensure that potential winter rearing habitat created by the project provides a net increase in the areal extent of habitat.
FISH-MM-3	*Avoidance and Monitoring of High Sound Pressure Levels during Pile-Driving Activities.* All permanent pile-driving activities will be conducted between July 15 and October 15 to avoid the peak migration of adult and juvenile coho salmon. All reasonable measures, including the use of vibratory hammers, dewatering, etc., will be incorporated to ensure that peak underwater SPLs in Redwood Creek remain below 180 dB at a distance of 10 meters from the pile; all temporary and permanent pile-driving activities will be monitored by a qualified fish biologist during the entire project.
Cultural Resources	
CR-MM-1	*Cultural Resources Education, Archaeological Monitoring, and Discovery Measures* NPS will conduct the following measures to ensure that there are no impacts to known and/or previously undiscovered cultural resources. ▪ Cultural Resources Education for Workers: NPS will provide training to all members of the construction team. Training will involve information regarding what types of cultural materials are likely present in the project area, how to identify cultural materials, and the procedures for contacting the appropriate parties in the event that cultural materials are encountered during construction activities. All construction personnel will be required to participate in the training, and NPS will prepare written guidelines for identification of cultural materials and procedures to follow in case of a discovery or potential discovery. ▪ Archaeological Monitoring: NPS will ensure that there is an archaeological monitor and representative of the Federated Indians of the Graton Rancheria (Coast Miwok)

	within 100 feet of recorded archaeological resources during ground disturbing activities. While the goal of the NPS is to preserve archaeological resources, this mitigation measure would ensure that if additional deposits associated with known sites are discovered, there will be an archaeologist and Native American representative on site to identify and assess the find and impacts immediately and to halt construction. An archaeologist will monitor all ground disturbances during construction to ensure that discoveries of previously unidentified resources are protected until they can be properly recorded and assessed, and management decisions can be made about their treatment. Avoidance in place or no adverse effect from project actions is the preferred approach to all discoveries that are potentially eligible for listing on the NRHP. Consultation with the State Historic Preservation Office will occur for any discoveries made during construction in accordance with 36 CFR 800.13. Discovery of Archaeological Resources During Construction: If buried cultural resources such as chipped stone or groundstone, historic debris, building foundations, or human bone are inadvertently discovered during grounddisturbing activities, work should stop in that area and within a 100-foot radius of the find until a qualified archaeologist can assess the significance of the find. Inadvertent discoveries will be treated in accordance with 36 CFR 800.13 (Protection of Historic Properties: Post-review discoveries). The archaeological resource will be assessed for its eligibility for listing on the NRHP in consultation with the SHPO and the Federated Indians of Graton Rancheria (if it is an indigenous archaeological site) and a determination of the project effects on the property will be made. If the site will be adversely affected, a treatment plan will also be prepared as needed during the assessment of the site's significance. Assessment of inadvertent discoveries may require archaeological excavations or archival research to determine resource significance. Treatment plans will fully evaluate avoidance, project redesign, and data recovery alternatives before outlining actions proposed to resolve adverse effects. If human skeletal remains are encountered, protocols under either federal or state law may apply depending on the jurisdiction. Regardless, all work shall stop in the vicinity of the discovery, and the find will be secured and protected in place. The Marin County coroner and Park Archaeologist will both be immediately notified. If a determination finds that the remains are Native American, and that no further coroner investigation of the cause of death is required, the coroner will then be required to contact the NAHC (pursuant to Section7050.5[c] of the California Health and Safety Code) and the County Coordinator of Indian Affairs. If the remains are on federal land or under federal jurisdiction, they will also be treated in accordance with the Native American Graves Protection and Repatriation Regulations at 43 CFR 10.4 (Inadvertent discoveries). According to the California Health and Safety Code, six or more human burials at one location constitute a cemetery (Section 8100), and disturbance of Native American cemeteries is a felony (Section 7052).
CR-MM-2	*Educate the Workers Conducting the Harding Grass Removal and Have an Archaeological Monitor in the Vicinity of the Fan Site* NPS will provide training for all personnel involved with nonnative species removal to facilitate recognition of potential archaeological materials and to avoid impacts to deposits. In addition, NPS will implement CR-MM-1 and retain an archaeologist to monitor in the vicinity of the Fan Site during Harding grass removal activities.

CR-MM-3	*Limit Compaction Methods Above the Recorded Deposit; Consult with NPS, the County, and FIGR; and Clarify Site Disposition During the Design Process* Compaction of the CA-MRN-674 may occur as a result of public access or bridge action alternatives. NPS will ensure that mechanical subsurface compaction does not occur in the vicinity of recorded deposits associated with CA-MRN-674. Consultation regarding project effects on CA-MRN-674 will be conducted between the National Park Service, the County of Marin, and the Federated Indians of Graton Rancheria as the final design for the bridge and access are in preparation, and may include additional subsurface surveys, possibly conducted as part of geotechnical borings, to clarify the status of CAMRN- 674 under portions of Pacific Way. If this assessment results in a finding of adverse effect, then the National Park Service will consult with the SHPO, in addition to the County of Marin and the Federated Indians of Graton Rancheria, to resolve the adverse effect.
Recreation	
REC-MM-1	*Construction Exclusion Areas* During construction, NPS will ensure that all active construction, staging, and stockpile areas are fenced to render them inaccessible to the public. Fencing will be a minimum of 8 feet high and will consist of chainlink or another equally secure material. To minimize visual intrusiveness of fencing, it will be designed and installed to blend into the surrounds as much as possible. All construction, staging, and stockpile access will be gated and gates will be kept locked except when in use. Signs will be conspicuously posted to inform the public about the need for caution. If it is necessary for construction vehicles or heavy equipment to travel outside the fenced construction area, flaggers, traffic cones and/or high visibility temporary construction fencing will be used to delineate construction equipment travel routes and alert the public to the presence of heavy equipment and/or slow-moving vehicles.
REC-MM-2	*Horse and Equestrian Safety Measures* In addition to, or in combination with, the general informational noticing for the project, NPS will ensure that public notices addressing horse and equestrian safety are posted on the NPS/GGNRA website, at all area equestrian facilities, at trailheads that serve equestrians, and on fencing at active construction sites. Notices will alert the public to the location, nature, and duration of construction activities and the potential for construction noise to frighten horses. Riders will be cautioned regarding the risk of horses shying and/or bolting, the risk of injury, and the risk of horses injuring themselves. Notices will provide information on alternate trail routes and other area equestrian facilities for use during construction, and will include a name, phone number, and e-mail address for an NPS staff member the public can contact with questions or concerns. Website and equestrian facility notices will be posted at least a month prior to construction each year, and will remain up throughout the construction season. Notices at the active construction site will be posted as soon as possible after exclusion fencing (see REC-MM-1) is erected.
Traffic Control	

TC-MM-1	*Construction Traffic Management Plan* As described in Chapter 2, appropriate signage would be placed at the intersection of Pacific Way and Hwy 1 to deter visitors from seeking parking at the beach during construction. Chapter 2 also outlines a communication strategy to keep residents and visitors apprised of the construction at Muir Beach, to help reduce parking demand and traffic conflicts. In addition to these measures, the following will be implemented: ▪ Develop and Implement a Traffic Control Plan: NPS and the County, in coordination with Caltrans, will develop and implement traffic control plan(s) for construction of the project. The plan will reduce the effects of construction on the roadway system in the project area throughout the construction period. Construction contractors will follow the standard construction specifications of affected jurisdictions and obtain the appropriate encroachment permits. The conditions of the encroachment permit will be incorporated into the construction contract and will be enforced by the agency that issues the encroachment permit. The following travel lane widths, speeds, and conditions will be maintained during project construction as much as possible: • For two-way traffic operations, the minimum width for the traveled way will be 20 feet, or a minimum of a 10-foot traffic lane in each direction. • For one-way operation, the minimum width for the traveled way will be 12 feet where some shoulder exists. In those areas where no shoulder is present, the minimum width for the traffic lanes will be 13 feet. • Any roadway or lane closures will be coordinated with the County and minimized during the morning and evening peak traffic periods. • Traffic control devices will be installed as specified in the California Department of Transportation's *Manual of Traffic Controls for Construction and Maintenance Works Zones* (California Department of Transportation 1996). Flaggers will be used as necessary for directional traffic controls. • The maneuvers of construction vehicles will not block or restrict the movement of adjacent traffic flows within the construction zone. • Safe pedestrian and bicyclist access will be maintained in or around the construction areas at all times. Construction areas will be secured as required by the applicable jurisdiction to prevent pedestrians and bicyclists from entering the work site. Alternate routes will be provided for bicyclists and pedestrians during sidewalk, bike lane, and recreation trail closures. Notification will be provided to the public of temporary closures of sidewalks, bike lanes, and recreation trails. • As part of the traffic control plan, a detailed construction traffic management plan will be developed to reduce the impacts of construction and employee traffic during construction. The plan will address such issues as employee parking and truck and equipment circulation around the work site. Written notification will be provided to all contractor employees regarding appropriate routes to and from the construction site, and the weight and speed limits on local roads used to access the construction site; • The traffic control plan will clearly identify staging areas, dump sites, operating hours, including the hours during which trucks will be traveling State Routes, project duration, scheduling and phasing. It will also identify the total number of construction vehicles and their respective haul routes, with hauling to be allowed on state routes only during off-peak hours.

	• A notification plan will be developed to notify business and residents in the construction area prior to onset of construction, as well as anyone else who may be affected by project construction. Signs will be posted at the construction site giving the name and telephone number or e-mail address of the NPS or County staff person designated to receive complaints regarding construction traffic. • Access to adjacent development in or near the construction areas will be maintained at all times. Provisions for traffic control will be made to allow primacy for emergency vehicles. During non-construction times, all trenches and other construction features will be covered to allow safe access to adjacent development. • Response times for police, fire, and emergency services could be temporarily affected by the project, thereby increasing the potential for property losses or hazards to human health. Coordination with these agencies will be completed as part of development of the traffic control plan, and these service providers will be notified prior to onset of construction to reduce the potential for property losses and hazards to human health. Priority access will be given to emergency service vehicles on Pacific Way. • Roadway damage, such as potholes, minor fractures, will be repaired, and the overall roadbed will be maintained within the construction areas, to the extent that such damage is caused by project traffic that occurs during the period of hauling operations. Following construction within a particular roadway segment, roadway restoration will take place within six weeks of completion of construction. County Design Guidelines will be adhered to when reconstructing County roads. Agreements on restoration standards will be formalized with the relevant jurisdiction (Marin County Public Works, and/or Caltrans), prior to the issuance of the work authorization permit.
Public Safety	
PS-MM-1	*Employ Sustainable Construction Practices* During the phases of site design, feature design and implementation, the NPS, its engineers and contractors shall implement the following mitigation measures: ▪ Minimize job site waste and reuse and recycle demolition and construction debris. Haul full loads, and minimize unnecessary vehicle trips. ▪ Design and engineer the bridge, roads and other structures to an appropriate and effective degree to support the uses they require and avoid over engineering. ▪ Design the bridge, roads and other structures for a 100-year lifespan or longer, and consider the deconstruction and reuse of the items and its materials during the design process. ▪ Minimize the use of resources, and avoid to the highest degree possible the choice of non-renewable, non-reusable materials. ▪ Stage and manage the construction job effectively, and adhere to the highest safety practices.
PS-MM-2	*Maintain Utility Services* A detailed study identifying locations of utilities within the proposed project shall be

	conducted during the design phase of the project. For areas with the potential for adverse impacts to utility services, the NPS or its contractors shall implement the following mitigation measures: ▪ Utility excavation or encroachment permits shall be required from the appropriate agencies. The permits include measures to minimize utility disruption. The NPS and its contractors shall comply with permit conditions. Such conditions shall be included in construction contract specifications. ▪ Utility locations shall be verified through a field survey (potholing) and use of the Underground Service Alert services. ▪ Detailed specifications shall be prepared as part of the design plans to include procedures for excavation, support, and fill of areas around utility cables and pipelines. All affected utility services shall be notified of NPS's construction plans and schedule. Arrangements shall be made with these entities regarding protection, relocation, or temporary disconnection of services. ▪ Residents and businesses in the project area shall be notified of planned utility service disruption 2 to 4 days in advance, in conformance with County and state standards. Disconnected cables and lines shall be reconnected promptly.
Human Health and Safety	
HS-MM-1	*Stop Work and Implement Hazardous Materials Investigation/Remediation* Prior to onset of construction, all construction workers shall be trained in the identification of potentially contaminated soil and/or water, including information on characteristics of potential contamination such as discolored soil, oils or sheens on water, and unusual odors. In the event that hazardous materials are encountered during construction, all construction activities in the area of the discovery will stop, and NPS shall conduct hazardous materials investigations to identify the nature and extent of contamination and evaluate potential impacts on project construction. If necessary, NPS shall implement remediation measures consistent with all applicable local, state, and federal codes and regulations. Construction will not resume until remediation is complete. If waste disposal is necessary, NPS shall ensure that all hazardous materials removed during construction are handled and disposed of by a licensed waste-disposal contractor and transported by a licensed hauler to an appropriately licensed and permitted disposal or recycling facility, in accordance with local, state and federal requirements.
Noise	
NZ-MM-1	*Employ Noise-Reducing Construction Practices* The construction contractor will employ noise-reducing construction practices, including, but not limited to: ▪ As much as possible, limiting hours of construction operation to the hours between 8:00 a.m. and 5:00 p.m., Monday through Friday and 10:00 a.m. and 4:00 p.m. on Saturdays, and no construction allowed on Sundays, ▪ Locating equipment as far as practical from noise sensitive uses, ▪ Using sound control devices such as mufflers on equipment, ▪ Using equipment that is quieter than standard equipment, ▪ Prohibiting vehicles and other gas- or diesel-powered equipment from unnecessary warming up, idling, and engine revving,

	▪ Selecting haul routes that affect the fewest number of people, ▪ Using noise-reducing enclosures around stationary noise-generating equipment, ▪ Shield/shroud any impact tools, ▪ Use vibratory pile driving in place of impact pile driving if feasible, and ▪ Pre-drill pile holes.
NZ-MM-2	*Prepare a Noise Control Plan* The construction contractor will prepare a detailed noise control plan based on the construction methods proposed. This plan will identify specific measurements that will be taken to minimize noise impacts, and ensure compliance with the identified noise limits where feasible. The noise control plan will be reviewed and approved by NPS staff before any noise-generating construction activity begins.
NZ-MM-3	*Disseminate Essential Information to Residences and Implement a Complaint/Response Tracking Program* The construction contractor will notify any residences within 1,000 feet of the construction areas of the construction schedule in writing, prior to construction. The construction contractor will designate a noise disturbance coordinator who will be responsible for responding to complaints regarding construction noise. The coordinator will determine the cause of the complaint and will ensure that reasonable measures are implemented to correct the problem. A contact telephone number for the noise disturbance coordinator will be conspicuously posted on construction site fences and will be included in the written notification of the construction schedule sent to nearby residents.
United States Fish and Wildlife Service	
USFWS	The following measures are conditions the National Park Service must implement to be in compliance with the Endangered Species Act. These conditions were promulgated under the February 5, 2008 Biological Opinion from the USFWS for this project. ▪ The conservation measures in the project shall be implemented as described in the Final EIS/EIR and the Project Description of the Biological Opinion. The conservation measures are listed below and described more fully in the Biological Opinion: o Limit construction access routes and equipment staging areas and conduct preconstruction surveys for the California red-legged frog in all suitable habitat that will be disturbed by project construction. o Within 50 feet of the California red-legged frog habitat, progressive clearing of vegetation will be conducted where necessary for construction by cutting vegetation from the overstory to ground level to allow animals to move out of the work area. o California red-legged frog breeding habitat will be augmented by creating a new off-site pond prior to construction, and reintroduction of the frog will be carried out at that site in coordination with the USFWS. o California red-legged frog populations and habitat conditions will be monitored at the project site on an on-going basis. o The California red-legged frog will be reintroduced to the project site to reestablish a viable breeding population there. Reintroduction will be coordinated with the USFWS.

	▪ If a California red-legged frog(s) are observed in the work areas, a qualified biologist or an individual trained in the biology and ecology of the listed amphibian and designated by the NPS shall capture it and move the animals(s) to an appropriate aquatic or upland location outside of the work area, or, if appropriate, the animal shall be allowed to leave the work area of its own volition. ▪ An education program for the field personnel involved with the project shall be conducted prior to the initiation of ground breaking. The program shall consist of a brief presentation by a person(s) knowledgeable in the California red-legged frog, and other appropriate listed species. The program shall include the following: a description of these species, and their ecology and habitat needs; an explanation of their legal status and their protection under the Act; and an explanation of the measures being taken to avoid or reduce effects to these species during the project. The education may be conducted in an informal manner (e.g., ranger and field personnel in a rural setting). ▪ If requested, during or upon completion of construction activities, the on-site biologist, and/or a representative from the NPS shall accompany Service and California Department of Fish and Game personnel at the project to review project effects to the California red-legged frog and its habitats. ▪ The NPS shall ensure compliance with the Reporting Requirements of the Biological Opinion. ▪ USFWS urges NPS to follow Conservation Recommendations outlined in the Biological Opinion.
National Marine Fisheries Service (NMFS)	
NMFS	The following reasonable and prudent measures are necessary and appropriate to minimize take of Central California Coast coho salmon (*Oncorhynchus kisutch)* and Central California Coast steelhead (*Oncorhynchus mykiss)* the National Park Service must implement to be in compliance with the Endangered Species Act. These conditions were promulgated under the October 15, 2008 Biological Opinion from the NMFS for this project. In addition to the non-discretionary actions listed below, NMFS also suggested discretionary conservation recommendations that would minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitat, or develop additional information. These conservation recommendations can be found in NMFS Biological Opinion. Reasonable and Prudent Measure 1: Undertake measures to ensure that harm and mortality to listed salmonids resulting from fish relocation and dewatering activities is low when stream flow is diverted around instream construction projects. • All screens used on equipment meant to divert flows must be screened in accordance with the NMFS Fish Screening Criteria for Anadromous Salmonids [available at: http://swr.nmfs.noaa.gov/hcd/fishscrn.pdf] and the Addendum for Juvenile Fish Screen Criteria for Pump Intakes [available at: http://swr.nmfs.noaa.gov/hcd/pumpcrit.pdf]. • The applicant shall retain a qualified biologist with expertise in the areas of anadromous salmonid biology, including handling, collecting, and relocating salmonids; salmonid/habitat relationships; and biological monitoring of salmonids. GGNRA shall ensure that all biologists working on this project be qualified to conduct fish collections in a manner which minimizes all potential risks to ESA-listed salmonids. Electrofishing, if used, shall be performed by a qualified biologist and conducted according to the NMFS Guidelines for Electrofishing Waters Containing

	Salmonids Listed under the Endangered Species Act [available at: http://www.nwr.noaa.gov/1salmon/salmesa/ 4ddocs/final4d/electro2000.pdf]. • Prior to construction commencing the applicant shall submit to NMFS for approval a plan for the cofferdams and diversion methods. The plan shall be sent to the NMFS Santa Rosa Area Office, Attention: John McKeon, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. • A qualified biologist shall monitor the construction site during placement and removal of channel diversions and cofferdams to ensure that any adverse effects to salmonids are minimized. The biologist shall be on site during all dewatering events to ensure that all ESA-listed salmonids are captured, handled, and relocated safely. The biologist shall notify NMFS biologist John McKeon at (707) 575-6069 or john.mckeon@noaa.gov one week prior to capture activities in order to provide an opportunity for NMFS staff to observe the activities. • ESA-listed fish shall be handled with extreme care and kept in water to the maximum extent possible during relocation activities. All captured fish shall be kept in cool, shaded, aerated water protected from excessive noise, jostling, or overcrowding any time they are not in the stream and fish shall not be removed from this water except when released. To avoid predation, the biologist shall have at least two containers and segregate young-of-year fish from larger age-classes and other potential aquatic predators. Captured salmonids will be relocated, as soon as possible, to a suitable instream location in which suitable habitat conditions are present to allow for adequate survival of transported fish and fish already present. • If any salmonids are found dead or injured, the biologist shall contact NMFS biologist John McKeon by phone immediately at (707) 575-6069 or NMFS Santa Rosa Area Office at (707) 575-6050. The purpose of the contact is to review the activities resulting in take and to determine if additional protective measures are required. All salmonid mortalities shall be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length measured, and frozen as soon as possible. Frozen samples shall be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than NMFS Santa Rosa Area Office without obtaining prior written approval from the Santa Rosa Area Office, Supervisor of the Protected Resources Division. Any such transfer will be subject to such conditions as NMFS deems appropriate. <u>Reasonable and Prudent Measure 2</u>: Undertake measures to minimize harm to listed salmonids resulting from channel and wetland restoration activities and development of infrastructure within the flood plain. • GGNRA shall ensure that the new channel design meets or exceeds the NMFS guidelines for salmonid passage and exceeds the upstream and downstream fish passage potential of the former channel. • GGNRA shall continuously monitor turbidity levels in the new channel at a minimum of two locations when the new channel is first occupied by full diversion of flows from the existing channel, and from October 15 through June 15 of the subsequent two years. NMFS shall be notified immediately if at any time the turbidity monitoring indicates exposure of salmonids to high levels of turbidity which (as detailed in Newcombe and Jensen, 1996) would be expected to cause changes in migratory behavior, significantly reduced growth rates, or mortality. Turbidity monitoring equipment data will be examined daily during the first two weeks after the initial channel diversion, and at a

	minimum on a weekly basis during the subsequent two winter seasons. • Silt curtains deployed to contain the elevated turbidity levels of newly excavated back water channels when connected to the main stream channel shall not be removed until the water in the new excavation has cleared to a minimum clarity of 18 inches as measured by secchi disk. • GGNRA shall notify NMFS Santa Rosa Area Office by letter, stating the project commencement date, at least 14 days prior to implementation. The letter shall be sent to NMFS Santa Rosa Area Office, Attention: Supervisor of Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. • GGNRA shall allow any NMFS employee(s) or any other person(s) designated by NMFS, to accompany field personnel to visit the construction site during activities described in this opinion. • A fisheries biologist shall monitor in-channel activities and performance of sediment control or detention devices for the purpose of identifying and reconciling any condition that could harm, injure, or kill salmonids. GGNRA will be responsible for identifying and rectifying these conditions. • Sediment shall be removed from sediment controls once it has reached one-third of the exposed height of the control. Whenever straw bales are used, they shall be staked and dug into the ground 12 centimeters (cm). Catch basins shall be maintained so that no more than 15 cm of sediment depth accumulates within traps or sumps. • Contractors must have a supply of erosion control materials onsite to facilitate a quick response to unanticipated storm events or emergencies. • Construction equipment used within the creek channel will be checked each day prior to work within the creek channel (top of bank to top of bank) and if necessary action will be taken to prevent fluid leaks. If leaks occur during work in the channel (top of bank to top of bank), GGNRA, or their contractor will contain the spill and remove the affected soils. • Road, bridge and parking lot drainage infrastructure shall include drop-in inlets designed to CalTrans Tahoe Valley specifications. This will allow the drainage structures to be fitted with PAH sorbent materials during the first flush of winter rains to minimize contamination of the stream, wetlands and lagoon with toxic substances emitted by vehicle access to the floodplain. Monitoring of infrastructure runoff during first flush events shall occur for five years after project completion to insure the efficacy of the toxics containment system. • No stop work penalties for work stoppage resulting from Federal ESA issues shall be included or agreed to in construction contracts. NMFS is including this term and condition to avoid providing financial disincentives to minimizing and avoiding take of ESA-listed salmonids. <u>Reasonable and Prudent Measure 3</u>: Prepare and submit a report to document effects of construction and relocation activities, project minimization and performance enhancement measures, and overall project performance. GGNRA shall provide a written report to NMFS by January 15 following completion of construction each year and for a period of 5 years following construction completion. The report shall be submitted to NMFS Santa Rosa Area Office Attention: Supervisor of Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The report shall contain, at a minimum, the following applicable (depending on year) information:

	• *Construction related activities* – The report shall include the dates construction began and was completed; photographs taken before, during, and after the activity from photo reference points; a discussion of any unanticipated effects or unanticipated levels of effects on salmonids and their habitat, a description of any and all measures taken to minimize those unanticipated effects and a statement as to whether or not the unanticipated effects had any affect on ESA-listed fish or designated critical habitat; and the number of salmonids killed or injured during the project action. • *Fish Passage* – The report shall document how the new channel meets or exceeds the NMFS guidelines for salmonid passage and exceeds the upstream and downstream fish passage and rearing potential of the old channel. Also, the report shall document at what flows salmonid passage through the new channel is possible and a description of the frequency, duration, and timing of those flows at that site. • *Revegetation* - The report shall include a description of the locations planted or seeded, the area (m2) revegetated, a plant palette, planting or seeding methods, the efforts taken to ensure success of new plantings, performance or success criteria, and pre- and post-planting color photographs of the revegetated area. • *Fish Relocation* - The report shall include a description of the location from which fish were removed and the release site including photographs; the date and time of the relocation effort; a description of the equipment and methods used to collect, hold, and transport salmonids; if an electroshocker was used for fish collection, a copy of the logbook must be included; the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances surrounding ESA-listed fish injuries or mortalities; and a description of any problems which may have arisen during the relocation activities and a statement as to whether or not the activities had any unforeseen effects. • *Lagoon Monitoring* – The report shall include monitoring results of lagoon conditions, and description and timing of barrier beach management activities and significant geophysical events such wave overwash events, lagoon closure, or natural or artificial breaching events. Water surface elevations and turbidity of the lagoon shall be continuously monitored. Twice-weekly dissolved oxygen and salinity profiles will be taken and results included in the report. Monitoring results for toxics in runoff from completed infrastructure during first flush events will be included in the report. Reasonable and Prudent Measure 4: Seek NMFS technical assistance for development of, and final approval of designs for all major components of the project. NPS will seek technical assistance and approval of project designs at the 30 percent, 60 percent and 100 percent design completion phases. This will be accomplished with regularly scheduled interagency design discussion meetings with prior provision of design materials. Final designs will be provided to NMFS at least 60 days prior to anticipated construction activities. NMFS will respond to NPS within 30 days of receipt of project designs. NMFS' response will either approve the project design or provide description of changes needed to remain within the anticipated take amounts described above.
Clean Water Act	
CWA	Section 404/401: A permit application was submitted to USACE in February 2008 that outlined activities that would discharge into waters of the U.S. Following issuance of this Record of Decision, as the regulatory agencies request, the permit process will be

	finalized when more detailed construction drawings have been provided to agency regulators. It is anticipated that additional project conditions will be placed on the project by both the U.S. Army Corps of Engineers as part of Section 404, and the San Francisco Bay Regional Water Quality Control Board as part of Section 401 Certification. These permit conditions will be incorporated into the project's implementation.

RESOLUTION NO. 2008-53
A RESOLUTION OF THE MARIN COUNTY BOARD OF SUPERVISORS

CERTIFYING THE WETLAND AND CREEK RESTORATION AT BIG LAGOON, MUIR BEACH FINAL ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT

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SECTION I: FINDINGS

I. WHEREAS, in 2004 the County and the National Park Service (NPS) initiated the environmental impact analysis process to address the environmental impacts of the Wetland and Creek Restoration at Big Lagoon, Muir Beach project (Big Lagoon Project). The environmental impact analysis process included extensive input from the public as well as from environmental and legal consultants. In accordance with the requirements of the California Environmental Quality Act (CEQA, Public Resources Code Sections 21000-211178.1) a Notice of Preparation of an Environmental Impact Report (EIS/EIR) for the Big Lagoon Project was circulated on April 27, 2004 to public agencies and all interested parties for a 30-day review and comment period. Scoping sessions were held on October 22, October 29, and November 2, 2002, with a site visit for the public held on November 9, 2002, to obtain public comment on issues to be considered in the EIS/EIR. In addition, two alternatives workshops were held for the public on September 30 and October 4, 2003; and

II. WHEREAS, the Draft Environmental Impact Statement/Environmental Impact Report (DEIS/EIR) (State Clearinghouse Number 2004042143) and a Notice Of Completion (NOC) and notice of public hearing on the DEIS/EIR were distributed on December 22, 2006, to members of the Planning Commission, Board of Supervisors, State Clearinghouse, state and local agencies and special districts, property owners and others requesting notice of the DEIS/EIR, and other interested groups and individuals. The NOC and notice of public hearing were published in a newspaper of general circulation to begin a 75-day public review and comment period on the adequacy of the DEIS/EIR, ending on March 6, 2007; and

III. WHEREAS, in conjunction with the release of the DEIS/EIR for the Big Lagoon Project, the County Planning Commission met on February 26, 2007 to receive testimony on the adequacy of the Draft EIS/EIR. Oral and written comments were presented at the hearing; and

IV. WHEREAS, following the close of the February 26, 2007 public hearing, the Commission directed that a Final EIS/EIR (FEIS/EIR) Response to Comments be prepared after the close of the comment period on the DEIS/EIR. On March 6, 2007 the public review and comment period on the DEIS/EIR was closed, and written comments were received on the DEIS/EIR until 4:00 p.m. on that date; and

V. WHEREAS, on December 21, 2007, the FEIS/EIR (December 2007) and a notice of distribution of the FEIS/EIR for review and notice of a public meeting of the Planning Commission to consider comments on the FEIS/EIR on March 10, 2008 were distributed to members of the Planning Commission, Board of Supervisors, State Clearinghouse, state and local agencies and special districts, EIS/EIR commentors, and other interested groups and individuals. Notice of distribution of the FEIS/EIR for review and notice of the public meeting of the Commission to consider recommendation for certification of the

FEIS/EIR was published in a newspaper of general circulation to begin a 45-day public review and comment period on the FEIS/EIR, which concluded on February 4, 2008; and

VI. WHEREAS, on February 4, 2008, the review and comment period on the FEIS/EIR was closed, and written comments were received on the FEIS/EIR until 4:00 p.m. on that date. These comments primarily addressed floodplain connectivity, sediment transport, salmonid rearing habitat and refuge, bridge/roadway design, siting of the parking lot, traffic congestion, fill disposal, and pedestrian access. In some instances comments required minor clarification or amplification of information, impact analysis or mitigations in the FEIS/EIR. A response by the EIS/EIR consultant has been provided for each of these issues raised in the comments. The Responses to Comments on the FEIS/EIR have been adopted as an Amendment to the FEIS/EIR to complete the FEIS/EIR as adequate for certification. Since the comments and responses result in only minor clarifications and insignificant changes to the FEIS/EIR, they do not trigger CEQA requirements for recirculation of the document for additional public review and do not prevent certification of the EIS/EIR as adequate and complete; and

VII. WHEREAS, on March 14, 2008, copies of the Amendment to the FEIS/EIR and a courtesy reminder notice of the Planning Commission meeting to consider recommendation for certification of the FEIS/EIR were distributed to members of the Commission, Board of Supervisors, Agencies, FEIS/EIR commentors and other interested parties. This notice contained a revised Planning Commission meeting date of March 24, 2008. The Amendment to the FEIS/EIR will be considered as part of the certified FEIS/EIR in making an informed decision on the project; and

VIII. WHEREAS, on March 24, 2008 the Marin County Planning Commission conducted a public meeting and voted without objection to recommend that the Board of Supervisors certify the FEIS/EIR for the Big Lagoon Project.

SECTION II: ACTION

IX. WHEREAS, the Marin County Board of Supervisors reviewed and considered the information in the DEIS/EIR, FEIS/EIR, FEIS/EIR Appendices, FEIS/EIR administrative record, FEIS/EIR Staff Report, and Amendment to the FEIS/EIR, for adequacy, completeness and compliance with CEQA, State CEQA Guidelines, and County Environmental Review Procedures; and

X. WHEREAS, on May 13, 2008, the Marin County Board of Supervisors conducted a public meeting to consider certification of the FEIS/EIR, and to receive testimony on the adequacy of the FEIS/EIR for certification, and considered comments on the FEIS/EIR together with staff's report recommending certification of the Final EIS/EIR.

NOW, THEREFORE, BE IT RESOLVED, that the Marin County Board of Supervisors makes the following findings:

1. The recitals above are true and accurate and reflect the independent judgment of the Board of Supervisors.

2. Notice of the Planning Commission and Board of Supervisors hearings on the project environmental review documents were given as required by law and the actions were conducted in accordance with CEQA, and the State CEQA Guidelines; and

3. All individuals, groups and agencies desiring to comment were given adequate opportunity to submit oral and written comments on the Draft EIS/EIR and to submit written comments on the adequacy of the Final EIS/EIR for certification. These opportunities for comment meet or exceed the requirements of CEQA and the County Environmental Review procedures; and

4. All comments submitted during the public review and comment period on the Draft EIS/EIR, the public hearings on the adequacy of the Draft EIS/EIR conducted by the Planning Commission and the public review and comment period on the Final EIS/EIR and hearing by the Planning Commission on the Final EIS/EIR for recommendation for certification were responded to adequately; and

5. The Big Lagoon Project Final Environmental Impact Statement/Environmental Impact Report consists of the FEIS/EIR, Appendices (including a draft mitigation monitoring and reporting plan), and a Response to Comments Amendment to the FEIS/EIR;

6. The Board of Supervisors were presented with all of the information in the administrative record, testimony, and EIS/EIR documents for the project FEIS/EIR, and the Board of Supervisors has reviewed and considered this information and the FEIS/EIR; and

7. The Final EIS/EIR (a) has been completed in compliance with the intent and requirements of CEQA and the State CEQA Guidelines, and the County EIR process, (b) reflects the independent judgment and analysis of the County of Marin, and (c) has been presented to and reviewed and considered by the Board of Supervisors in its deliberations regarding approval of the Big Lagoon Project.

NOW, THEREFORE, BE IT FURTHER RESOLVED, that the Marin County Board of Supervisors certifies the Final Environmental Impact Report for the Big Lagoon Project as adequate and complete in compliance with CEQA, the State CEQA Guidelines and the County Environmental Review Procedures, and adequate and complete for consideration in making a decision on the merits of the project.

SECTION III: VOTE

PASSED AND ADOPTED at the regular meeting of the Board of Supervisors of the County of Marin, State of California, on the 13th day of May, 2008, by the following vote to-wit:

AYES:	SUPERVISORS	Steve Kinsey, Judy Arnold, Susan L. Adams, Charles McGlashan
NOES:	NONE	
ABSENT:	SUPERVISOR	Harold C. Brown, Jr.

CHARLES MCGLASHAN, PRESIDENT
MARIN COUNTY BOARD OF SUPERVISORS

Attest:

Matthew H. Hymel
Clerk of the Board

RESOLUTION NO. 2008-53
A RESOLUTION OF THE MARIN COUNTY BOARD OF SUPERVISORS

CERTIFYING THE WETLAND AND CREEK RESTORATION AT BIG LAGOON, MUIR BEACH FINAL ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT

* *

SECTION I: FINDINGS

I. WHEREAS, in 2004 the County and the National Park Service (NPS) initiated the environmental impact analysis process to address the environmental impacts of the Wetland and Creek Restoration at Big Lagoon, Muir Beach project (Big Lagoon Project). The environmental impact analysis process included extensive input from the public as well as from environmental and legal consultants. In accordance with the requirements of the California Environmental Quality Act (CEQA, Public Resources Code Sections 21000-211178.1) a Notice of Preparation of an Environmental Impact Report (EIS/EIR) for the Big Lagoon Project was circulated on April 27, 2004 to public agencies and all interested parties for a 30-day review and comment period. Scoping sessions were held on October 22, October 29, and November 2, 2002, with a site visit for the public held on November 9, 2002, to obtain public comment on issues to be considered in the EIS/EIR. In addition, two alternatives workshops were held for the public on September 30 and October 4, 2003; and

II. WHEREAS, the Draft Environmental Impact Statement/Environmental Impact Report (DEIS/EIR) (State Clearinghouse Number 2004042143) and a Notice Of Completion (NOC) and notice of public hearing on the DEIS/EIR were distributed on December 22, 2006, to members of the Planning Commission, Board of Supervisors, State Clearinghouse, state and local agencies and special districts, property owners and others requesting notice of the DEIS/EIR, and other interested groups and individuals. The NOC and notice of public hearing were published in a newspaper of general circulation to begin a 75-day public review and comment period on the adequacy of the DEIS/EIR, ending on March 6, 2007; and

III. WHEREAS, in conjunction with the release of the DEIS/EIR for the Big Lagoon Project, the County Planning Commission met on February 26, 2007 to receive testimony on the adequacy of the Draft EIS/EIR. Oral and written comments were presented at the hearing; and

IV. WHEREAS, following the close of the February 26, 2007 public hearing, the Commission directed that a Final EIS/EIR (FEIS/EIR) Response to Comments be prepared after the close of the comment period on the DEIS/EIR. On March 6, 2007 the public review and comment period on the DEIS/EIR was closed, and written comments were received on the DEIS/EIR until 4:00 p.m. on that date; and

V. WHEREAS, on December 21, 2007, the FEIS/EIR (December 2007) and a notice of distribution of the FEIS/EIR for review and notice of a public meeting of the Planning Commission to consider comments on the FEIS/EIR on March 10, 2008 were distributed to members of the Planning Commission, Board of Supervisors, State Clearinghouse, state and local agencies and special districts, EIS/EIR commentors, and other interested groups and individuals. Notice of distribution of the FEIS/EIR for review and notice of the public meeting of the Commission to consider recommendation for certification of the

FEIS/EIR was published in a newspaper of general circulation to begin a 45-day public review and comment period on the FEIS/EIR, which concluded on February 4, 2008; and

VI. WHEREAS, on February 4, 2008, the review and comment period on the FEIS/EIR was closed, and written comments were received on the FEIS/EIR until 4:00 p.m. on that date. These comments primarily addressed floodplain connectivity, sediment transport, salmonid rearing habitat and refuge, bridge/roadway design, siting of the parking lot, traffic congestion, fill disposal, and pedestrian access. In some instances comments required minor clarification or amplification of information, impact analysis or mitigations in the FEIS/EIR. A response by the EIS/EIR consultant has been provided for each of these issues raised in the comments. The Responses to Comments on the FEIS/EIR have been adopted as an Amendment to the FEIS/EIR to complete the FEIS/EIR as adequate for certification. Since the comments and responses result in only minor clarifications and insignificant changes to the FEIS/EIR, they do not trigger CEQA requirements for recirculation of the document for additional public review and do not prevent certification of the EIS/EIR as adequate and complete; and

VII. WHEREAS, on March 14, 2008, copies of the Amendment to the FEIS/EIR and a courtesy reminder notice of the Planning Commission meeting to consider recommendation for certification of the FEIS/EIR were distributed to members of the Commission, Board of Supervisors, Agencies, FEIS/EIR commentors and other interested parties. This notice contained a revised Planning Commission meeting date of March 24, 2008. The Amendment to the FEIS/EIR will be considered as part of the certified FEIS/EIR in making an informed decision on the project; and

VIII. WHEREAS, on March 24, 2008 the Marin County Planning Commission conducted a public meeting and voted without objection to recommend that the Board of Supervisors certify the FEIS/EIR for the Big Lagoon Project.

SECTION II: ACTION

IX. WHEREAS, the Marin County Board of Supervisors reviewed and considered the information in the DEIS/EIR, FEIS/EIR, FEIS/EIR Appendices, FEIS/EIR administrative record, FEIS/EIR Staff Report, and Amendment to the FEIS/EIR, for adequacy, completeness and compliance with CEQA, State CEQA Guidelines, and County Environmental Review Procedures; and

X. WHEREAS, on May 13, 2008, the Marin County Board of Supervisors conducted a public meeting to consider certification of the FEIS/EIR, and to receive testimony on the adequacy of the FEIS/EIR for certification, and considered comments on the FEIS/EIR together with staff's report recommending certification of the Final EIS/EIR.

NOW, THEREFORE, BE IT RESOLVED, that the Marin County Board of Supervisors makes the following findings:

1. The recitals above are true and accurate and reflect the independent judgment of the Board of Supervisors.

2. Notice of the Planning Commission and Board of Supervisors hearings on the project environmental review documents were given as required by law and the actions were conducted in accordance with CEQA, and the State CEQA Guidelines; and

3. All individuals, groups and agencies desiring to comment were given adequate opportunity to submit oral and written comments on the Draft EIS/EIR and to submit written comments on the adequacy of the Final EIS/EIR for certification. These opportunities for comment meet or exceed the requirements of CEQA and the County Environmental Review procedures; and

4. All comments submitted during the public review and comment period on the Draft EIS/EIR, the public hearings on the adequacy of the Draft EIS/EIR conducted by the Planning Commission and the public review and comment period on the Final EIS/EIR and hearing by the Planning Commission on the Final EIS/EIR for recommendation for certification were responded to adequately; and

5. The Big Lagoon Project Final Environmental Impact Statement/Environmental Impact Report consists of the FEIS/EIR, Appendices (including a draft mitigation monitoring and reporting plan), and a Response to Comments Amendment to the FEIS/EIR;

6. The Board of Supervisors were presented with all of the information in the administrative record, testimony, and EIS/EIR documents for the project FEIS/EIR, and the Board of Supervisors has reviewed and considered this information and the FEIS/EIR; and

7. The Final EIS/EIR (a) has been completed in compliance with the intent and requirements of CEQA and the State CEQA Guidelines, and the County EIR process, (b) reflects the independent judgment and analysis of the County of Marin, and (c) has been presented to and reviewed and considered by the Board of Supervisors in its deliberations regarding approval of the Big Lagoon Project.

NOW, THEREFORE, BE IT FURTHER RESOLVED, that the Marin County Board of Supervisors certifies the Final Environmental Impact Report for the Big Lagoon Project as adequate and complete in compliance with CEQA, the State CEQA Guidelines and the County Environmental Review Procedures, and adequate and complete for consideration in making a decision on the merits of the project.

SECTION III: VOTE

PASSED AND ADOPTED at the regular meeting of the Board of Supervisors of the County of Marin, State of California, on the 13th day of May, 2008, by the following vote to-wit:

AYES:	SUPERVISORS	Steve Kinsey, Judy Arnold, Susan L. Adams, Charles McGlashan
NOES:	NONE	
ABSENT:	SUPERVISOR	Harold C. Brown, Jr.

CHARLES MCGLASHAN, PRESIDENT
MARIN COUNTY BOARD OF SUPERVISORS

Attest:

Matthew H. Hymel
Clerk of the Board