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.

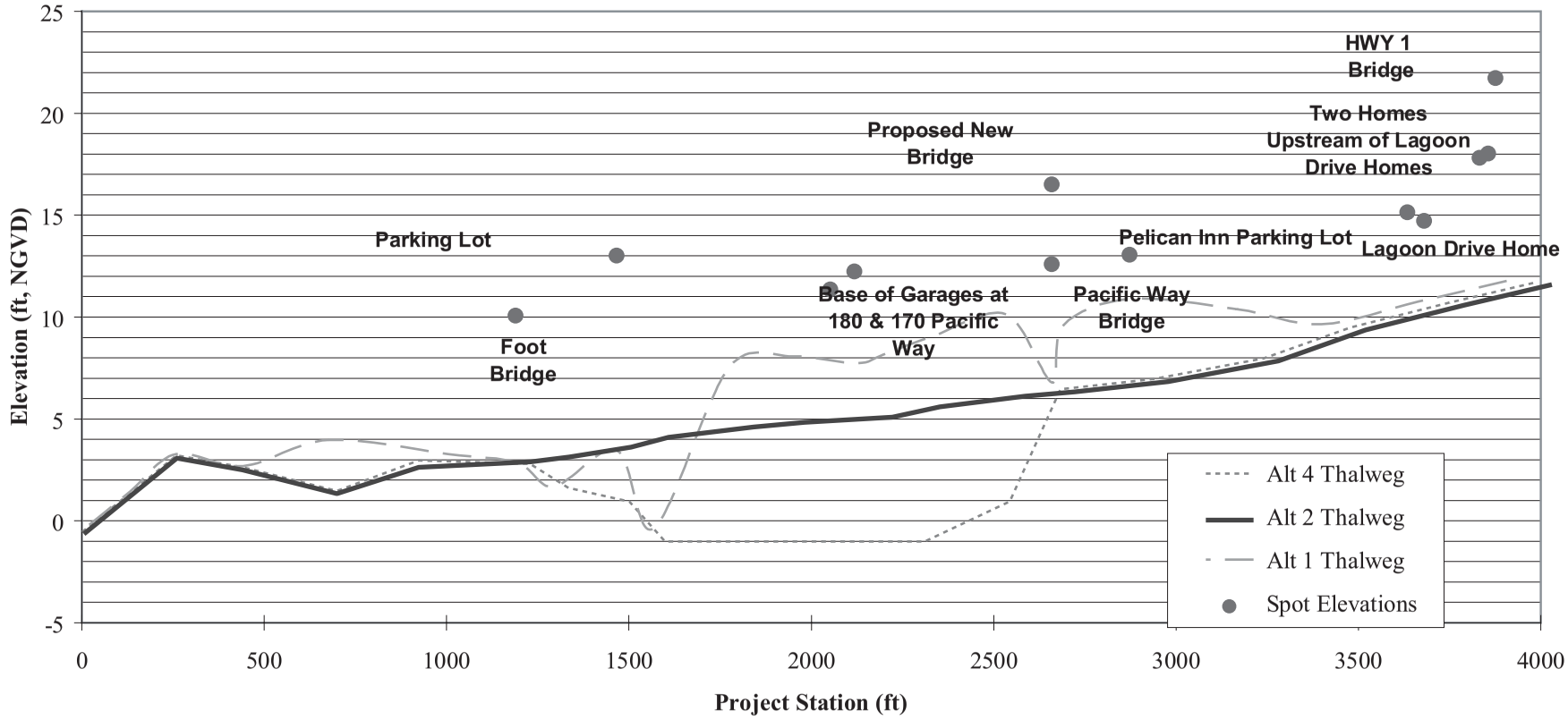
Bridge Alternative BR2: Negligible. The narrow bridge span and low roadway would result in continued concerns related to channel stability, floodplain connectivity, and natural channel function.

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.

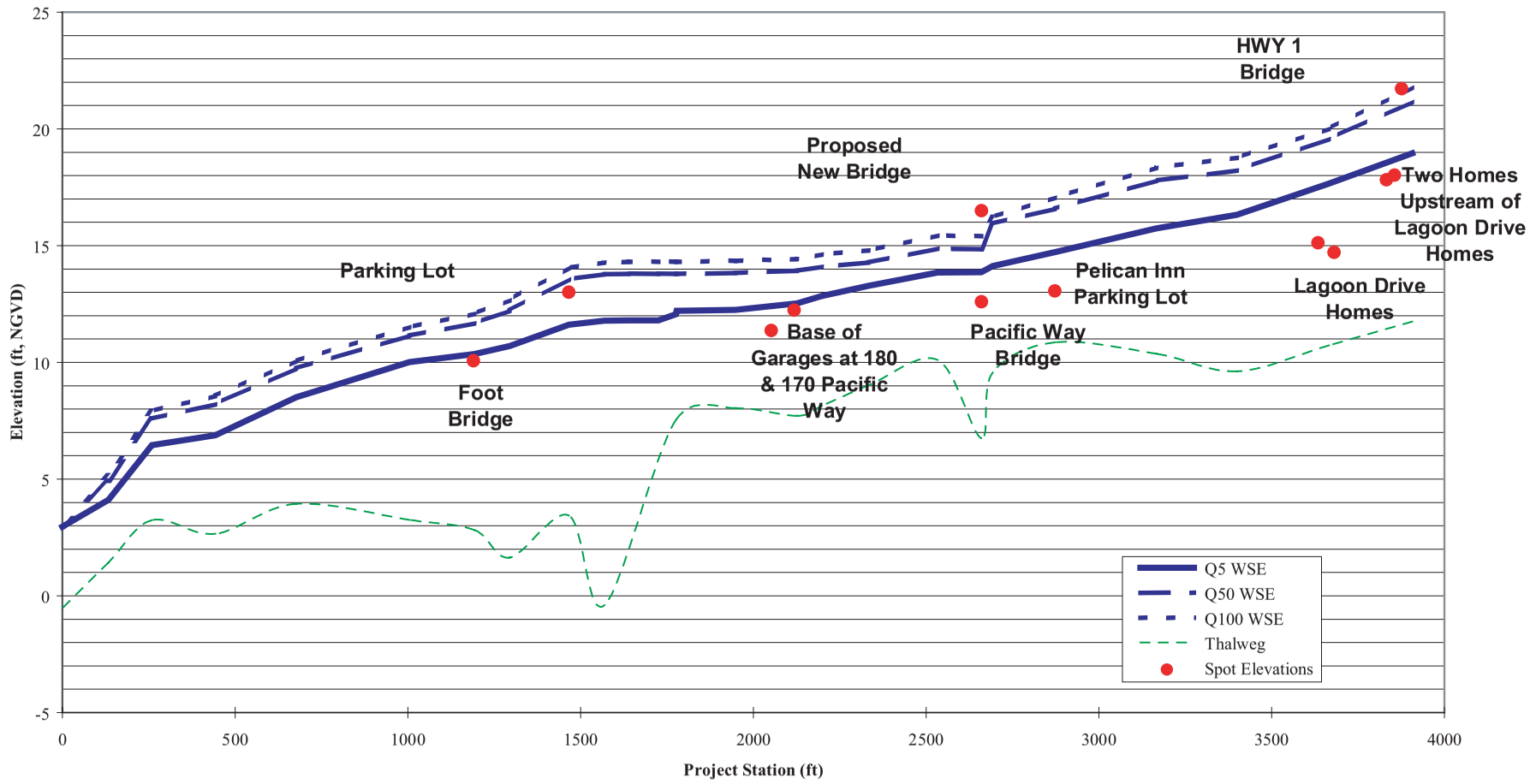


Source: PWA 2006

05052.05 DEIS/EIR (11-06)

Jones & Stokes

Figure 4.3.1-1
Comparison of Channel Thalweg for Alternative 1



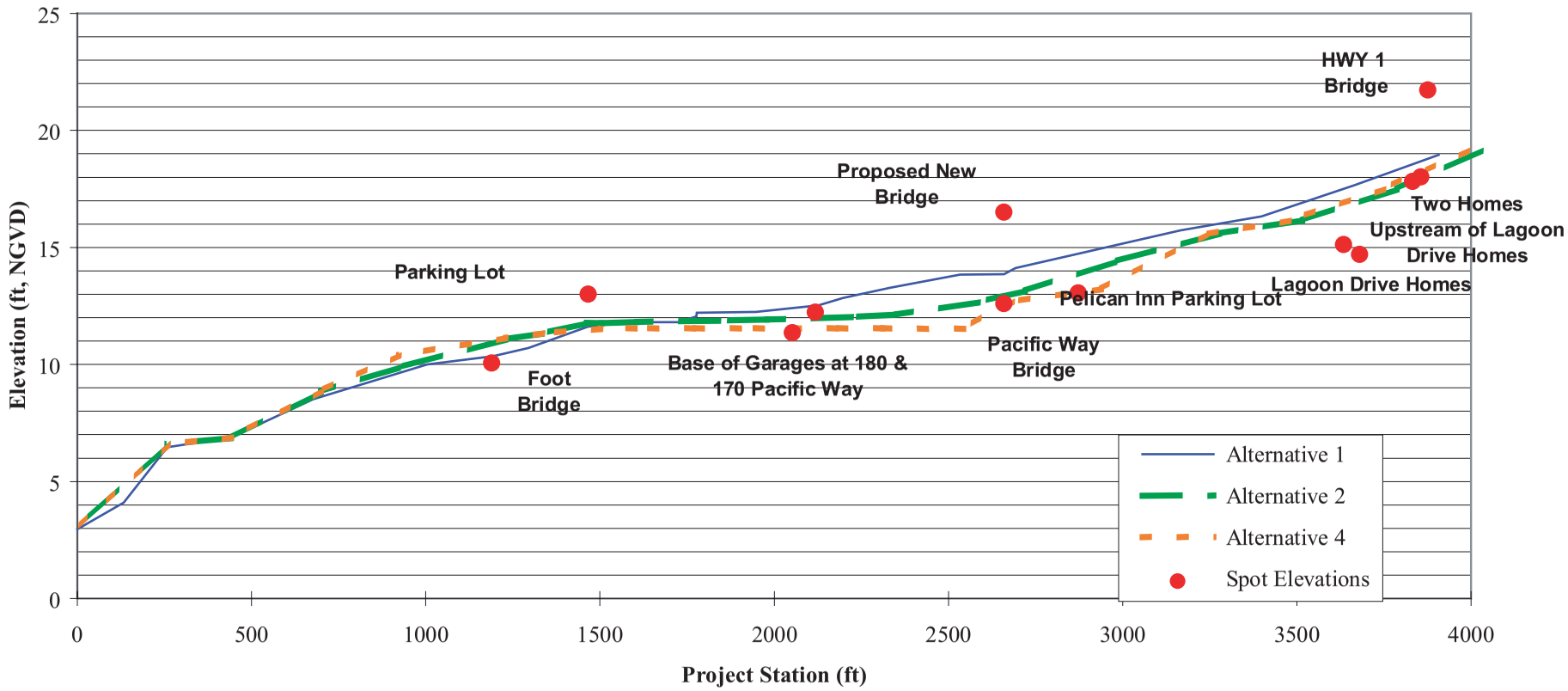
Notes: Chainages based on each Alternative 1 MIKE network. Spot elevations based on Alternative 1 MIKE network.

Source: PWA 2006

05052.05 ADEIS/EIR (7-06)

Jones & Stokes

Figure 4.3.1-2
Comparison of Water Levels for Alternative 1 during Q5, Q50, Q100



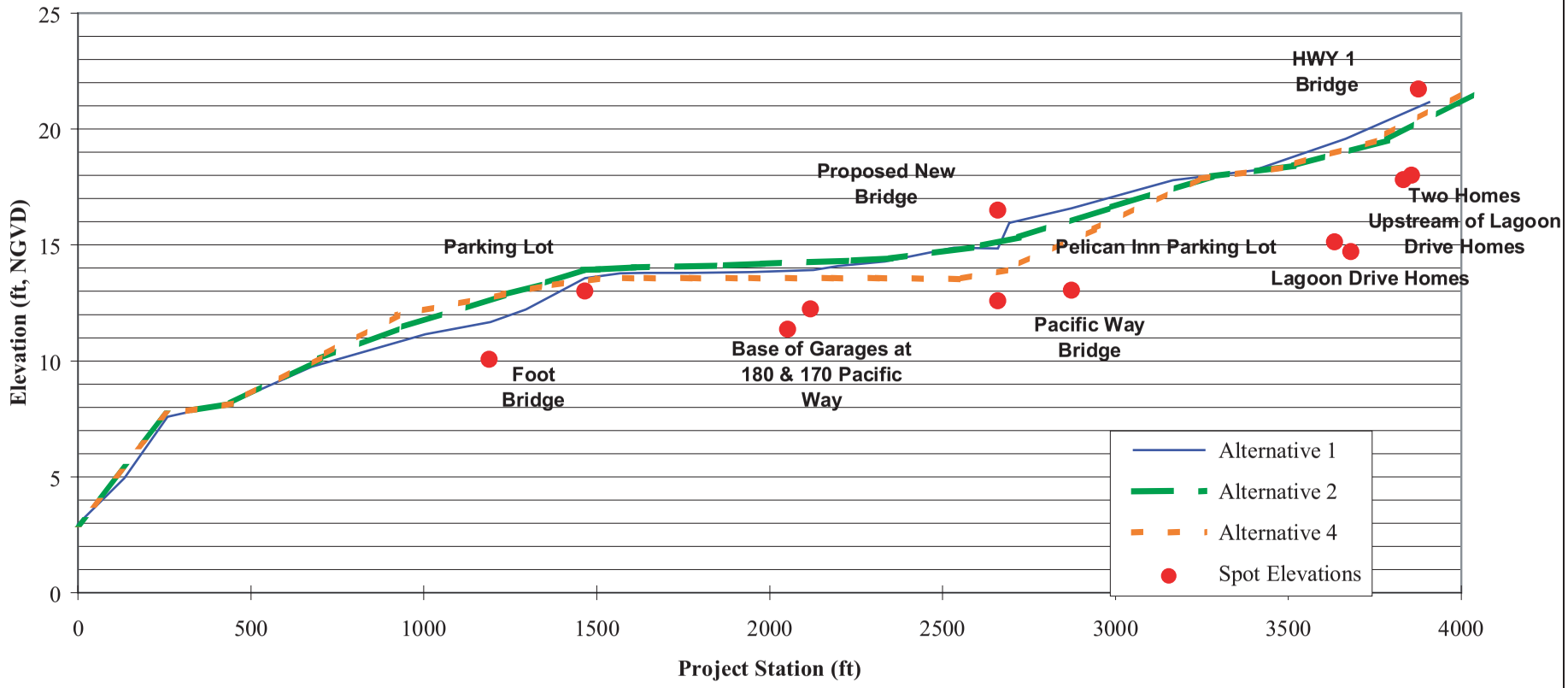
Notes: Chainages based on each Alternative's MIKE network. Spot elevations based on Alternative 1 Mike network

Source: PWA 2006

05052.05 ADEIS/EIR (7-06)

Jones & Stokes

Figure 4.3.1-3
Comparison of Water Levels for Alternatives 1, 2, and 4 at Year 5 during Q5



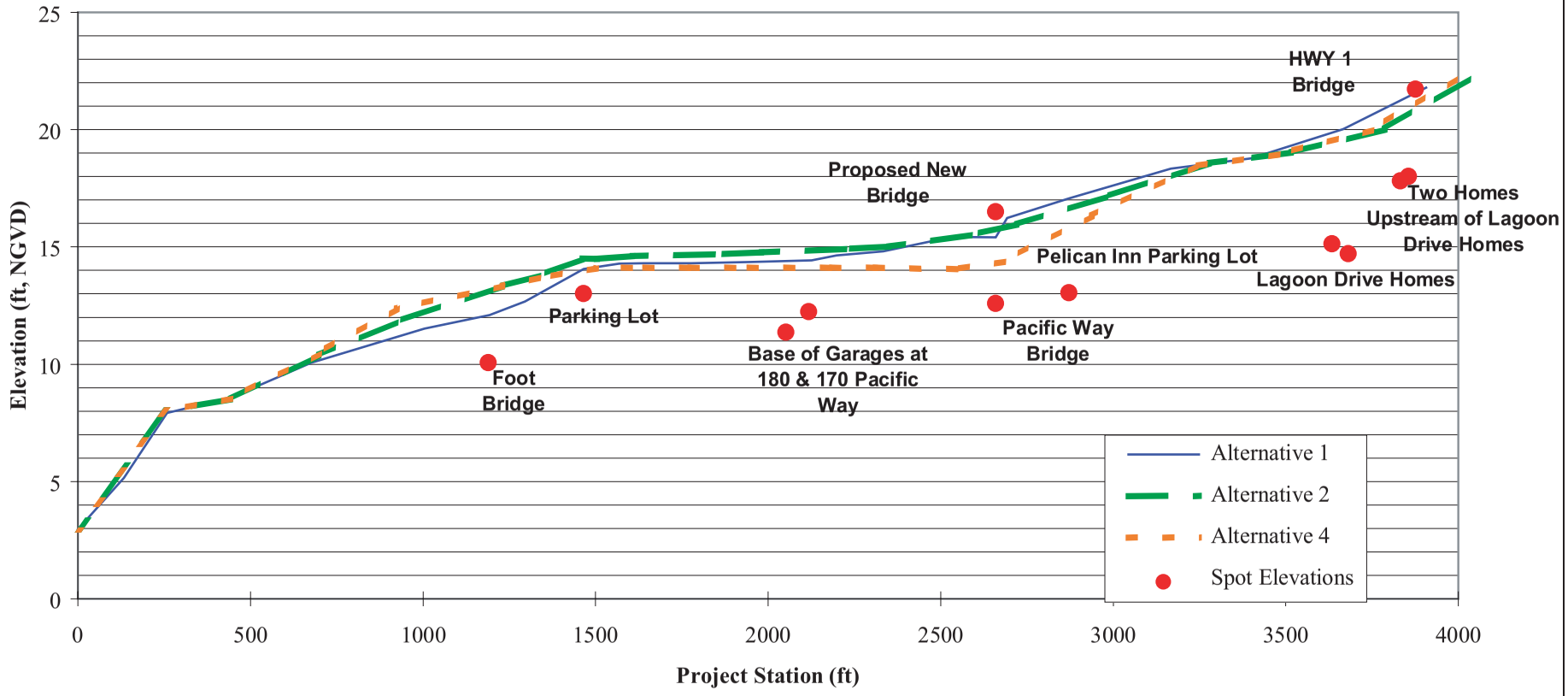
Notes: Chainages based on each Alternative's MIKE network. Spot elevations based on Alternative 1 Mike network

Source: PWA 2006

05052.05 ADEIS/EIR (7-06)

Jones & Stokes

Figure 4.3.1-4
Comparison of Water Levels for Alternatives 1, 2, and 4 at Year 5 during Q50



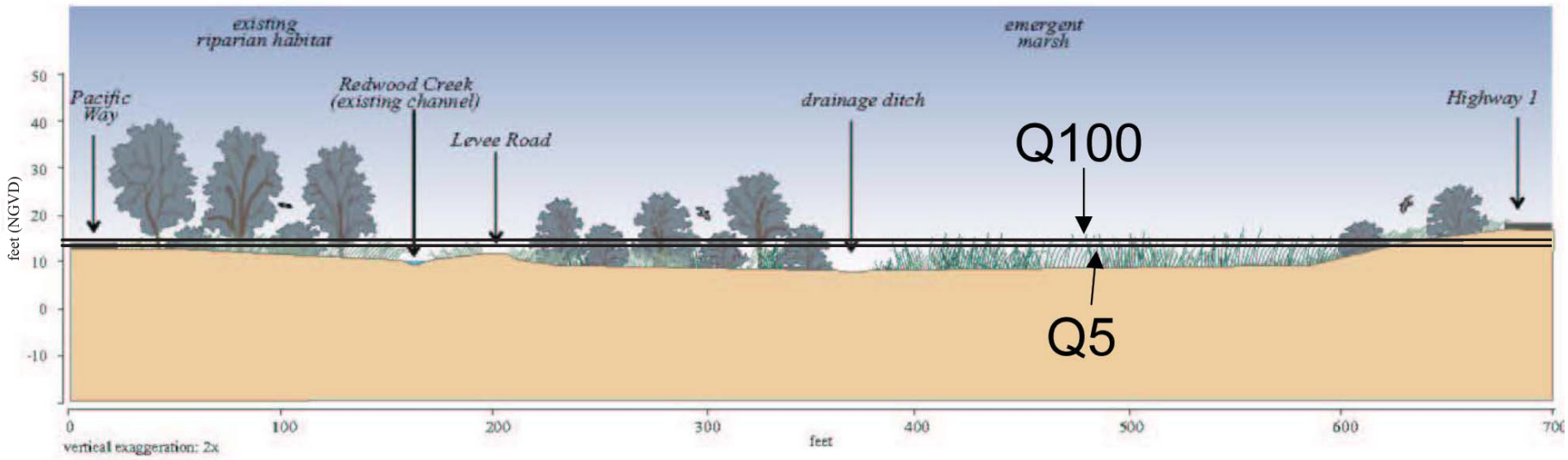
Notes: Chainages based on each Alternative's MIKE network. Spot elevations based on Alternative 1 Mike network

Source: PWA 2006

05052.05 ADEIS/EIR (7-06)

Jones & Stokes

Figure 4.3.1-5
Comparison of Water Levels for Alternatives 1, 2, and 4 at Year 5 during Q100

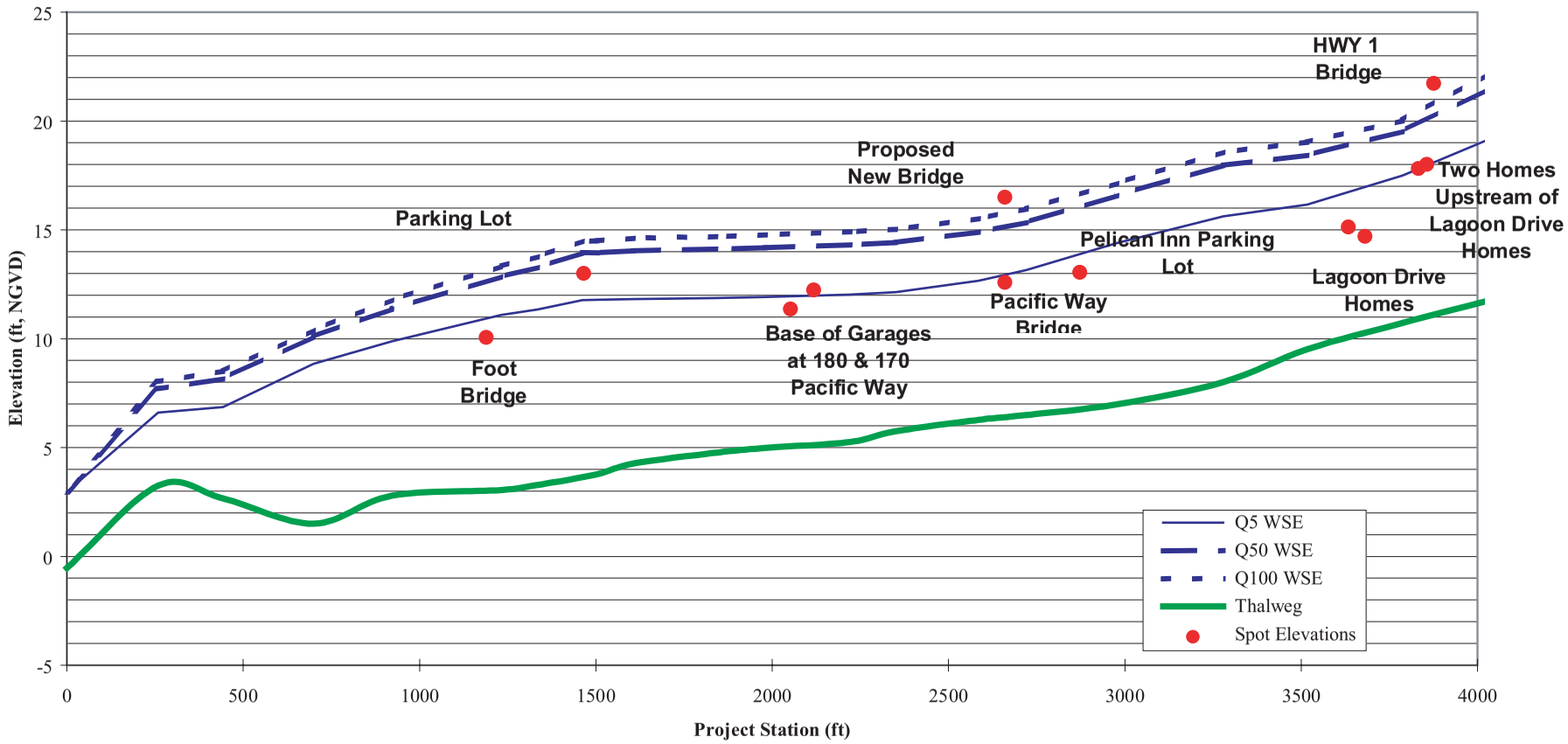


Source: PWA 2006

05052.05 EIS/EIR (rev 9-06)

Jones & Stokes

Figure 4.3.1-6
Flooding Scenario, Restoration Alternative 1



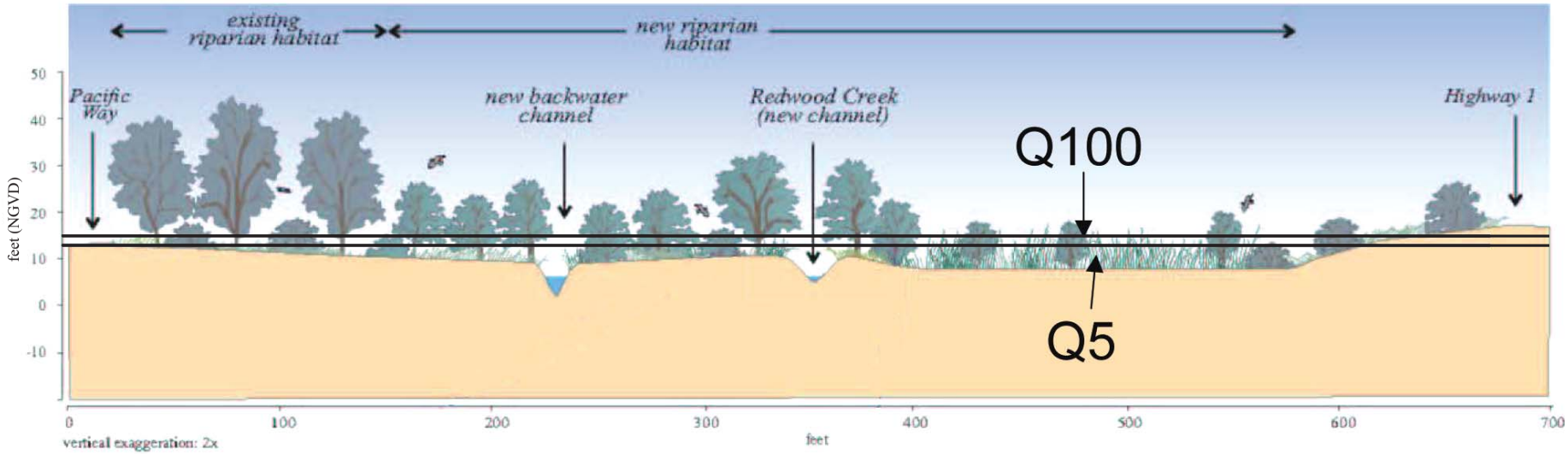
Notes: Chainages based on each Alternative 2 MIKE network. Spot elevations based on Alternative 1 MIKE network

Source: PWA 2006

05052.05 ADEIS/EIR (7-06)

Jones & Stokes

Figure 4.3.1-7
Comparison of Water Levels for Alternative 2 during Q5, Q50, and Q100

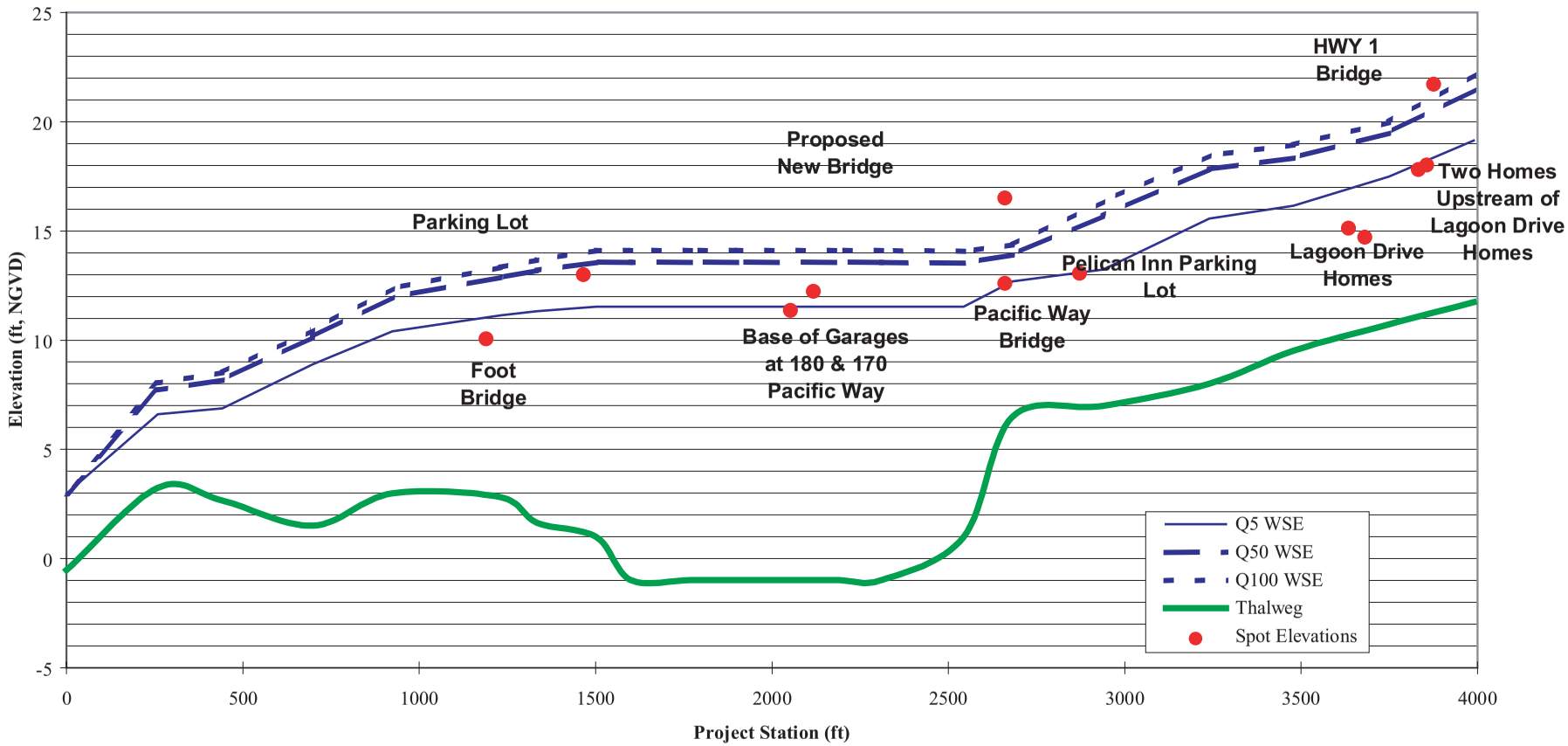


Source: PWA 2006

05052.05 EIS/EIR (rev9-06)

Jones & Stokes

Figure 4.3.1-8
Flooding Scenario, Restoration Alternative 2



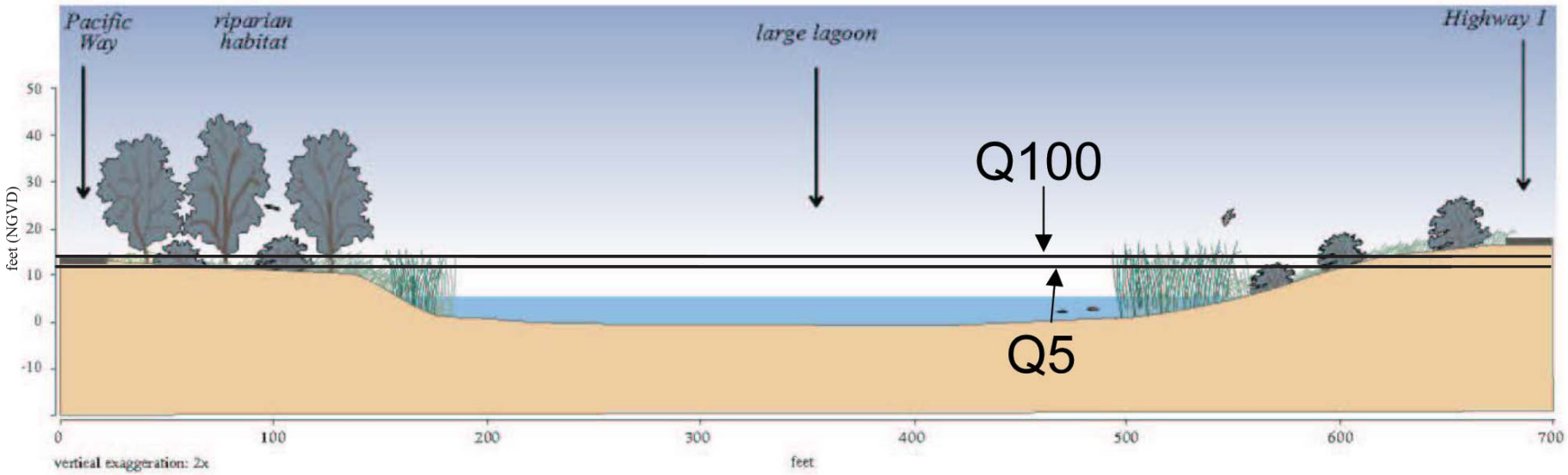
Notes: Chainages based on each Alternative 4 MIKE network. Spot elevations based on Alternative 1 MIKE network.

Source: PWA 2006

05052.05 ADEIS/EIR (7-06)

Jones & Stokes

Figure 4.3.1-9
Comparison of Water Levels for Alternative 4 during Q5, Q50, and Q100



Source: PWA 2006

05052.05 EIS/EIR (rev 9-06)

Jones & Stokes

Figure 4.3.1-10
Flooding Scenario, Restoration Alternative 4

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.

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 ($\mu g/m^3$)		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.

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).

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	

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.	

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.

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	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	
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.

<u>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.</u>

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 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
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.

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.

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

	Significance 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
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.

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 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
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.

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.

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.

Plan Policy	Consistency Analysis: Discussion	Consistency Analysis: 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.

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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.

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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

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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.

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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.

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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.

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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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Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
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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Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
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.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
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.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
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.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
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.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
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.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
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.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
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.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
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.

	Consistency Analysis	
Plan Policy	**Discussion**	**Conclusion, Including Recommendations to Eliminate Inconsistencies**
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		

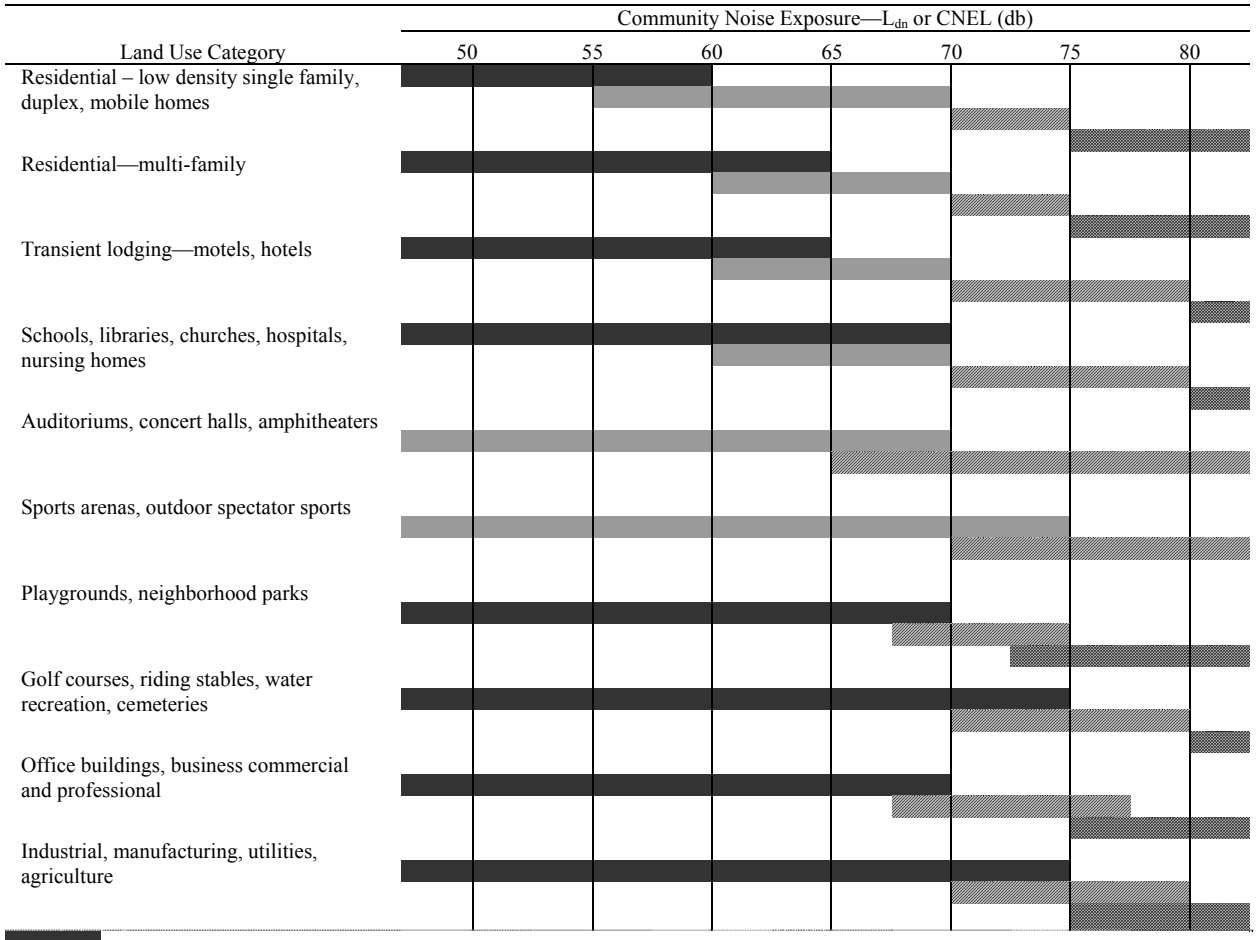
Program N-2.4a from the County's Noise Element restricts the hours of construction to times of the day during which noise would not normally disturb noise-sensitive land uses. The County's Planning Division has indicated that, typically, construction hours are determined on a project-by-project basis, 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.

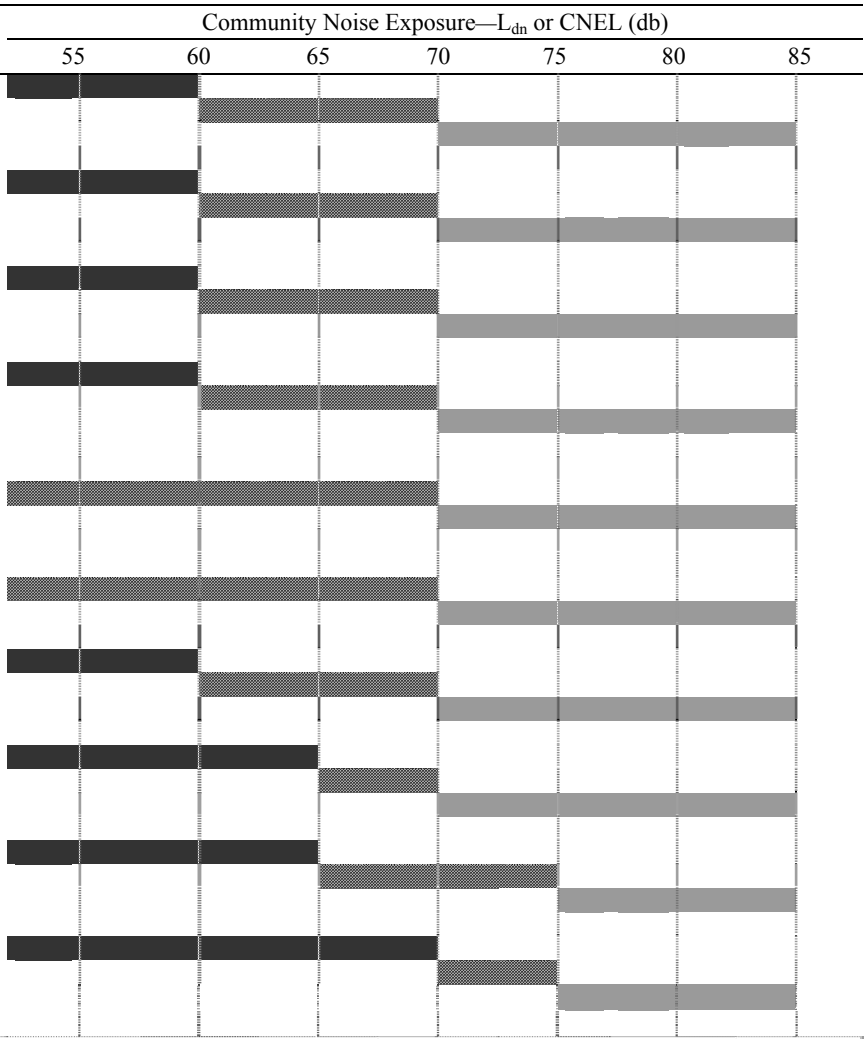
Conditionally Acceptable
New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features are included in the design. Conventional construction, but with closed windows and fresh air supply systems or 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.

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.

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 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
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 (0.04 to 0.09 a~~c~~res gained~~), a~~nd 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.