



GOLDEN GATE NATIONAL RECREATION AREA MUIR WOODS NATIONAL MONUMENT

DRAFT GENERAL MANAGEMENT PLAN/ENVIRONMENTAL IMPACT STATEMENT

VOLUME II

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INTRODUCTION

This part of the document describes the existing environment of Golden Gate National Recreation Area and Muir Woods National Monument. This discussion serves to identify the current conditions in the park that could be affected by the implementation of any of the alternatives in this plan. The information is organized around six general topics: natural resources, cultural resources, visitor use and experience, social and economic environment, transportation, and park operations, although there is some overlap between social and economic environment and transportation.

Regarding the discussion of the first three topics—natural resources, cultural resources, and visitor use and experience—differences between the two units are distinct enough to warrant separate discussions for Golden Gate National Recreation Area and Muir Woods National Monument. However, because of the proximity of the two units, and their similar relationships to the urban centers within the planning area, combined discussions that incorporate information about both units are presented for the last three topics.

Table 1, beginning on the next page, presents more detailed information on specific impact topics and the reasons that each was retained or dismissed from further evaluation.

SUMMARY TABLE OF IMPACT TOPICS

Table 1: Impact Topics Retained For or Dismissed From Detailed Analysis

Impact Topic (<i>Retained or Dismissed</i> from further analysis)	Rationale	Relevant Law, Regulation, or Policy
Natural Resources		
Carbon Footprint and Air Quality Retained	<p>Retained as an impact topic for further detailed analysis because of the interest in minimizing greenhouse gas emissions and reducing the carbon footprint of the park and monument, the Bay Area, and the state of California. The focus of the analysis is on greenhouse gas emissions related to NPS operational activities and how that would vary among the alternatives included in the plan.</p> <p>The park and monument are within the Class II air quality areas under the Clean Air Act, as amended. A Class II designation indicates the maximum allowable increase in concentrations of pollutants over baseline concentrations of sulfur dioxide and particulate matter as specified in Section 163 of the Clean Air Act.</p> <p>The California Clean Air Act of 1988, as amended, sets ambient air quality standards that are stricter than the federal standards and requires local air districts to promulgate and implement rules and regulations to attain those standards. Under the act, California Ambient Air Quality Standards are set for all pollutants covered under national standards, as well as vinyl chloride, hydrogen sulfide, sulfates, and visibility-reducing particulates. If an area does not meet the California standards, it is designated as a state nonattainment area.</p> <p>Golden Gate National Recreation Area and Muir Woods National Monument are in the San Francisco Bay Area Air Basin, which consists of San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa, Napa, and Marin Counties, as well as portions of Sonoma and Solano counties. The Bay Area</p>	<p>Clean Air Act; Executive Order 13423;</p> <p>DOI Secretarial Order 3226, Amendment No.1;</p> <p>California Global Warming Solutions Act of 2006 (AB32);</p> <p>NPS <i>Management Policies</i> 2006;</p> <p>NPS Pacific West Region Directive PW-047</p>

Impact Topic (Retained or Dismissed from further analysis)	Rationale	Relevant Law, Regulation, or Policy
	<p>Air Quality Management District is the air quality agency responsible for the entire basin. The San Francisco Bay Area is designated a federal nonattainment area for ozone and a state nonattainment area for ozone and inhalable particulate matter.</p> <p>Dust and exhaust emissions would be produced by development activities and the potential for increased vehicular traffic to the park and monument; however, these activities would not be expected to cause national ambient air quality standards to be exceeded because visitation increases would be relatively small and the level of new development proposed is minimal. Air quality impacts from the use of prescribed fire were analyzed in the park's <i>Fire Management Plan / Environmental Impact Statement</i>. Any amount of pollutants added because of the actions proposed in this general management plan would be negligible compared to existing levels. None of the actions described in this plan would violate any air quality standard or result in a cumulatively considerable net increase of any criteria pollutant for which the Bay Area is in nonattainment under federal or state ambient air quality standards. Implementation of any of the alternatives described in the plan would have negligible effects on air quality and the Class II air quality status of the park and monument would be unaffected.</p>	
<p>Soils and Geologic Resources and Processes (including natural shoreline and coastal processes) Retained</p>	<p>Soils and geologic resources and processes are an important component of maintaining the ecological integrity of the park and monument. Actions included in the plan, such as recreational facility development, changes in visitor use, and restoration, could affect soils and natural coastal processes. Any impacts that would adversely affect soils or geologic processes would be of concern to NPS managers and the public. Therefore, this topic was retained for detailed analysis.</p>	<p>NPS <i>Management Policies 2006</i></p>

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Impact Topic (<i>Retained or Dismissed</i> from further analysis)	Rationale	Relevant Law, Regulation, or Policy
<p>Water Resources and Hydrologic Processes (including stream character, water quantity and quality, watershed processes, wetlands, floodplains, and marine/estuarine resources)</p> <p>Retained</p>	<p>Water resources and hydrologic processes are an important component of the ecological communities of the park and monument. Development can alter, and has altered in the past, natural surface flows and watershed processes, with subsequent effects on the natural environment. Actions included in the plan, such as recreational facility development and stream/habitat restoration could affect water quality, wetlands, floodplains, and watershed processes. Therefore, water resources and hydrologic processes were retained for detailed analysis.</p>	<p>Clean Water Act; Executive Order 12088;</p> <p>Executive Order 11990;</p> <p>Executive Order 11988;</p> <p><i>NPS Management Policies 2006</i>;</p> <p>Director's Order 77-1;</p> <p>Director's Order 77-2</p>
<p>Habitat (Vegetation and Wildlife)</p> <p>Retained</p>	<p>Terrestrial and aquatic habitat is an important resource that defines the natural environment. The park and monument contain a diversity of plant and animal habitats. Actions included in the plan, such as recreational facility development, changes in visitor use, and restoration, could affect natural habitat values. Proposed actions could beneficially or adversely affect these resources, which would be of concern to NPS managers and the public. Therefore, this topic was retained for detailed analysis.</p>	<p>NPS Organic Act;</p> <p><i>NPS Management Policies 2006</i></p>
<p>Special Status Species: Federal Threatened and Endangered</p> <p>Retained</p>	<p>The park and monument host a variety of federal listed species. Actions included in the plan, such as recreational facility development, changes in visitor use, and habitat restoration, could affect the quality of habitat preferred by many of these species, as well as the behavior of certain species.</p> <p>Therefore, the following federal listed species were retained for detailed analysis: northern spotted owl, coho salmon, steelhead trout, California red-legged frog, Mission blue butterfly, tidewater goby, western snowy plover, San Francisco lessingia, San Francisco garter snake, and San Bruno elfin butterfly.</p>	<p>Endangered Species Act;</p> <p>Migratory Bird Treaty Act;</p> <p><i>NPS Management Policies 2006</i></p>

Impact Topic (Retained or Dismissed from further analysis)	Rationale	Relevant Law, Regulation, or Policy
	See appendix D for a listing of all special status species considered. All species that have been retained for analysis are identified in the appendix table.	
Special Status Species: State Threatened and Endangered Retained	The park and monument host a number of state listed species. Actions included in the plan, such as recreational facility development, changes in visitor use, and habitat restoration, could affect the quality of habitat preferred by one of these species, as well as the behavior of the species. Therefore, the following state listed species was retained for detailed analysis: bank swallow	Endangered Species Act; California Endangered Species Act; <i>NPS Management Policies 2006</i>
Special Status Species: Other Federal and State listed Species Dismissed	Several other federal and state listed species that are known to occur in the area were dismissed because 1) these species are typically not found in the park or monument, 2) their preferred habitat would not be physically disturbed by any of the GMP alternatives, or 3) the effects of actions included in the alternatives on these species would be negligible. See appendix D for a listing of all special status species considered. All species that have not been identified as "Retained" were dismissed for one or more of the above reasons.	Endangered Species Act; Bald and Golden Eagle Protection Act; Migratory Bird Treaty Act; Marine Mammal Protection Act; National Environmental Policy Act; California Endangered Species Act; NPS <i>Management Policies 2006</i>
Essential Fish Habitat Dismissed	In accordance with the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act, federal agencies that fund, permit, or carry out activities that may adversely impact essential fish habitat are required to consult with the National Marine Fisheries Service regarding the potential adverse effects of their actions on essential	Magnuson-Stevens Fishery Conservation and Management Act

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Impact Topic (<i>Retained or Dismissed</i> from further analysis)	Rationale	Relevant Law, Regulation, or Policy
	<p>fish habitat; such agencies must also respond in writing to National Marine Fisheries Service recommendations.</p> <p>Essential fish habitat is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Waters include aquatic areas and their associated physical, chemical, and biological properties. Substrate includes sediment underlying the waters. “Necessary” means the habitat required to support a sustainable fishery and the species’ contribution to a healthy ecosystem. Spawning, breeding, feeding, or growth to maturity covers all habitat types used by a species throughout its life cycle. The conservation of essential fish habitat is an important component of building and maintaining sustainable fisheries. Loss or degradation of essential fish habitat is primarily the result of activities such as point and nonpoint water pollution, livestock grazing, mining, road construction, estuarine or marine habitat alteration, creation of migration barriers or hazards, increases or decreases in sediment delivery, and alteration of stream banks, shorelines, wetlands, and floodplains.</p> <p>The San Francisco Bay, a migratory corridor between riverine habitat and the Pacific Ocean, is designated critical habitat for several listed fish species. Habitat loss and degradation is primarily the result of overfishing, timber harvest, point and nonpoint water pollution, livestock grazing, mining, road construction, diking and stream bank stabilization, and dredge and fill activities.</p> <p>None of the actions proposed in the GMP alternatives would contribute to essential fish habitat loss or degradation. Some of the actions described in this plan would contribute to improvements in the quality or quantity of essential fish habitat; however, additional environmental compliance and</p>	

Impact Topic (Retained or Dismissed from further analysis)	Rationale	Relevant Law, Regulation, or Policy
	consultation with National Marine Fisheries Service would take place prior to implementation of these specific projects. Therefore, the topic of essential fish habitat was dismissed from further analysis.	
Marine Protected Areas Retained	Executive Order 13158, "Marine Protected Areas," defines marine protected areas as any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein. The executive order requires every federal agency to identify its actions that affect the natural or cultural resources that are protected by a marine protected area and, to the extent permitted by law and the maximum extent practicable, to avoid harming these resources. There are several federal- and state-designated marine protected areas near the park. The marine and estuarine area of Golden Gate National Recreation Area was designated a federal marine protected area under the national system of marine protected areas on May 25, 2010. Impacts to the natural and cultural resources protected by these marine protected areas are analyzed under their respective topics and marine protected areas are not included as a separate impact topic.	Executive Order 13158
Prime and Unique Farmlands Dismissed	In August 1980, the Council on Environmental Quality (CEQ) directed that federal agencies assess the effects of their actions on farmland soils classified as prime or unique by the U.S. Department of Agriculture's Natural Resource Conservation Service. Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops (e.g., citrus, tree nuts, olives,	Farmland Protection Policy Act; Council on Environmental Quality 1980 memorandum

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Impact Topic (<i>Retained or Dismissed</i> from further analysis)	Rationale	Relevant Law, Regulation, or Policy
	<p>cranberries, fruit, and vegetables). The Farmland Protection Policy Act (7 USC 4201 <i>et seq.</i>) and the U.S. Department of the Interior (Environmental Statement Memorandum No. ESM94-7 – Prime and Unique Agricultural Lands) require an evaluation of impacts on prime or unique agricultural lands.</p> <p>According to Natural Resource Conservation Service soils data, prime and unique farmlands do exist within the jurisdictional boundaries of Golden Gate National Recreation Area in San Mateo County at and adjacent to the Rancho Corral de Tierra property. All of these farmlands (with one small exception) are in private ownership and will not be acquired or managed by the National Park Service as part of the future land transfer with the Peninsula Open Space Trust. The one exception is an approximately 5-acre piece of farmland (adjacent to the privately owned Aenlle property) that contains prime soils and is scheduled to be acquired by the National Park Service as part of the land transfer. Once acquired, the National Park Service intends to use the land for native plant production supporting landscape restoration projects in the park. Consequently, no loss of prime soils or their potential for agricultural production would occur. However, the management zone used in the preferred alternative and in one or more of the other alternatives (Diverse Visitor Opportunities zone) allows for facility development, diverse visitor uses, and ecosystem restoration. Should the National Park Service decide to discontinue the agricultural use of the prime farmland and convert it to a nonagricultural use that could adversely impact its soil resources and its use and potential for agricultural production, then the National Park Service would be required to evaluate the impacts on prime farmland and consult with the NRCS.</p> <p>Within Golden Gate National Recreation Area</p>	

Impact Topic (Retained or Dismissed from further analysis)	Rationale	Relevant Law, Regulation, or Policy
	<p>in Marin County, only Farmland of Statewide Importance exists—there are no prime and unique farmlands. Based on a determination by Natural Resource Conservation Service in 2007, soils and farmland in the vicinity of the Lower Redwood Creek property are not classified as prime or unique farmland (Parson 2007).</p> <p>In addition, there are no prime and unique farmlands within the boundaries of Muir Woods National Monument. Therefore, this topic was dismissed from further analysis.</p>	
<p>Natural or Depletable Resource Requirements and Conservation Potential Dismissed</p>	<p>None of the alternatives being considered would result in the extraction of new resources from Golden Gate National Recreation Area or Muir Woods National Monument. In all of the alternatives, ecological principles would be applied to ensure that the natural resources of the park and monument were maintained and protected. Certain resources could continue to be collected for scientific and educational purposes, and the specimens would be stored in the NPS collection. Agricultural operations on NPS lands would continue to result in the harvesting of crops, which assist in meeting cultural landscape objectives. The fields would be managed to sustain this harvest. Implementation of the alternatives would result in the use of limited natural resources and energy for construction and operation of new recreational facilities and for restoration activities. New development would be designed to be sustainable to the maximum extent practicable. The use and consumption of fuel and other nonrenewable resources for NPS operations, activities, and development associated with the alternatives would be very small in comparison to that of the region. Overall, the impact on this topic would likely be negligible and thus it was dismissed from detailed analysis.</p>	<p>National Environmental Policy Act; Council on Environmental Quality</p>

PART 7: THE AFFECTED ENVIRONMENT

Impact Topic (<i>Retained or Dismissed</i> from further analysis)	Rationale	Relevant Law, Regulation, or Policy
<p>Energy Requirements and Conservation Potential</p> <p>Dismissed</p>	<p>Council on Environmental Quality guidelines for implementing the National Environmental Policy Act (NEPA) require examination of energy requirements and conservation potential in environmental impact statements. NPS staff strive to incorporate the principles of sustainable design and development into all facilities and park operations. Sustainability can be described as the result achieved by doing things in ways that do not compromise the environment or its capacity to provide for present and future generations. Sustainable practices minimize the short-term and long-term environmental impacts of developments and other activities through resource conservation, recycling, waste minimization, and the use of energy efficient and ecologically responsible materials and techniques.</p> <p>The NPS <i>Guiding Principles of Sustainable Design</i> (1993) provides a basis for achieving sustainability in facility planning and design, emphasizes the importance of bio-diversity, and encourages responsible decisions. The guidebook describes principles to be used in the design and management of visitor facilities that emphasize environmental sensitivity in construction, use of nontoxic materials, resource conservation, recycling, and integration of visitors within natural and cultural settings. The National Park Service would minimize energy costs, eliminate waste, and conserve energy resources by using energy efficient and cost effective technology wherever possible. Recent examples include projects to install photovoltaic panels on the NPS Headquarters building at Upper Fort Mason and projects to pursue alternative energy options at Alcatraz Island. Energy efficiency would also be incorporated into any decision-making process during the design or acquisition of facilities, as well as all decisions affecting park operations.</p> <p>The use of value analysis and value</p>	<p>National Environmental Policy Act;</p> <p>Council on Environmental Quality</p>

Impact Topic (Retained or Dismissed from further analysis)	Rationale	Relevant Law, Regulation, or Policy
	engineering, including life cycle cost analysis, would be performed to examine energy, environmental, and economic implications of proposed NPS development. National Park Service staff would encourage suppliers, permittees, and contractors to follow sustainable practices and would address sustainable park and park partner practices in interpretive programs. Consequently, any adverse impacts relating to energy use, availability, or conservation would be negligible. Therefore, energy requirements and conservation potential was dismissed from further analysis.	
Cultural Resources		
Archeological Resources Retained	Actions included in the plan, such as recreational facility development, changes in visitor use, and ecosystem restoration, could result in impacts to archeological resources. Therefore, this topic has been retained for detailed analysis.	National Historic Preservation Act; National Environmental Policy Act; Secretarial Order 13007; Director's Order 28; <i>NPS Management Policies 2006</i> ; NPS-28A, "Archeological Resources Management"
Cultural Landscapes Retained	Actions included in the plan, such as recreational facility development, changes in visitor use, and ecosystem restoration, could result in impacts to the integrity and function of identified or potential cultural landscapes. Therefore, this topic has been retained for detailed analysis.	<i>NPS Management Policies 2006</i> ; NPS-28, "Cultural Resources Management"
Ethnographic Resources Retained (for	No identified ethnographic resources exist in the park and monument, except for resources at Alcatraz Island that may have ethnographic significance to certain American	National Environmental Policy Act;

PART 7: THE AFFECTED ENVIRONMENT

Impact Topic (<i>Retained or Dismissed</i> from further analysis)	Rationale	Relevant Law, Regulation, or Policy
Alcatraz Island only)	Indians. Actions included in the plan, such as recreational facility development, changes in visitor use, and restoration, could result in impacts to potential ethnographic resources at Alcatraz Island. Therefore, this topic has been retained for detailed analysis.	Secretarial Order 13007; Director's Order 28; NPS Management Policies 2006; NPS-28, "Cultural Resources Management"
Historic Structures Retained	Many of the structures in the park and monument are listed or have been determined eligible for listing in the National Register of Historic Places. Actions included in the plan, such as adaptive reuse of structures and changes in visitor use, could result in impacts to historic structures. Therefore, this topic has been retained for detailed analysis.	National Historic Preservation Act; <i>NPS Management Policies 2006</i> ; NPS-28, "Cultural Resources Management"
Park Collections Retained	Actions included in the plan, such as options for the use, curation, and storage of park collections, could result in impacts to park collections. Therefore, this topic has been retained for detailed analysis.	National Historic Preservation Act; <i>NPS Management Policies 2006</i> ; Director's Order 24, "Museum Collections Management"
Indian Trust Resources Dismissed	Secretarial Order 3175 requires that any anticipated impacts on Indian trust resources from a proposed project or action by Department of the Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. There are no Indian trust resources or sacred sites in the park or monument; therefore, this	Secretarial Order 3175

Impact Topic (Retained or Dismissed from further analysis)	Rationale	Relevant Law, Regulation, or Policy
	topic was dismissed from further consideration.	
Visitor Use and Experience		
<p>Visitor Use and Experience (including diversity of recreation opportunities; visitor access; experience of the park setting; visitor understanding, education, and interpretation; and visitor safety)</p> <p>Retained</p>	<p>Enjoyment of the park resources by visitors is part of the fundamental purpose of a national park unit. The visitor experience is an important issue that could be appreciably affected under the alternatives. The Organic Act and NPS <i>Management Policies 2006</i> direct the National Park Service to provide enjoyment opportunities that are uniquely suited and appropriate to the resources found in the park and monument. The types and levels of access are important components of visitor use and experience and are of concern to many people as well as NPS managers. Therefore, this topic was retained for detailed analysis.</p>	<p>Enabling legislation; NPS <i>Management Policies 2006</i></p>
<p>Lightscape (Dark Night Sky Preservation)</p> <p>Dismissed</p>	<p>Due to its urban setting, light pollution is present in many areas of Golden Gate National Recreation Area and Muir Woods National Monument, although some areas retain a high degree of natural darkness. The National Park Service strives to minimize the intrusion of artificial light into the night scene by limiting the use of artificial outdoor lighting to basic safety requirements, shielding the lights when possible, and using minimal impact lighting techniques. Any new facilities proposed in the alternatives that would necessitate new nighttime lighting would be constructed with down lighting that would minimize light pollution. Furthermore, the level and type of new development and lighting proposed in the plan is minimal and dispersed. The effects of actions contained in this plan on natural lightscapes would be negligible to minor. Therefore, lightscape was dismissed from further analysis.</p>	<p>NPS Organic Act; Enabling legislation; NPS <i>Management Policies 2006</i></p>

PART 7: THE AFFECTED ENVIRONMENT

Impact Topic (<i>Retained or Dismissed</i> from further analysis)	Rationale	Relevant Law, Regulation, or Policy
Public Health and Safety Dismissed	The proposed developments and actions included as part of the GMP alternatives would not result in any identifiable adverse impacts on human health or safety. Furthermore, visitor safety is addressed under the topic of visitor use and experience. Therefore, public health and safety was dismissed from further analysis.	Council on Environmental Quality regulations; Director's Order 12 Handbook
Soundscape (Natural Sound Preservation) Dismissed	<p>An important part of the NPS mission is the preservation of natural soundscapes associated with national park system units. Natural soundscapes exist in the absence of human-caused sound. The natural ambient soundscape is the aggregate of all the natural sounds that occur in a park unit, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive and can be transmitted through air, water, or solid materials. The frequencies, magnitudes, and durations of human-caused sound considered acceptable varies among national park system units, as well as potentially throughout each park unit; generally acceptable levels are greater in developed areas and less in undeveloped areas.</p> <p>Unnatural sounds, often a byproduct of recreational activities, can be intrusive and can impact natural soundscape conditions that affect visitor experience and use and wildlife. The National Park Service has taken significant steps to preserve natural soundscapes and manage human-caused noise, especially at Muir Woods National Monument where data collection, research, and management actions have improved the natural soundscape and successfully led to improved visitor experiences. Actions included in the plan would not substantially change visitor use and the generation of human-caused noise compared to current conditions; consequently, sound conditions in the park and monument would not be expected to be substantially affected—the</p>	NPS Organic Act; <i>NPS Management Policies 2006</i> ; Director's Order 47

Impact Topic (Retained or Dismissed from further analysis)	Rationale	Relevant Law, Regulation, or Policy
	impact to the natural soundscape would be negligible to minor. Therefore, this topic was dismissed from further analysis.	
Social and Economic Environment		
Social and Economic Retained	The social and economic conditions of the Bay Area and the gateway counties of Marin, San Francisco, and San Mateo influence Golden Gate National Recreation Area and Muir Woods National Monument and how they are managed. Conversely, the park and monument directly contributes to the social and economic conditions of these three counties and the Bay Area as a whole. This section describes the potential beneficial and adverse impacts related to this relationship by highlighting the park's quality of life benefits as well as the Bay Area's demographic and economic trends.	National Environmental Policy Act
Conformity with Local Land Use Plans Dismissed	The basic land use of the park and monument as a public recreation and resource management area is in conformance with local land use plans. The creation of additional recreation and visitor service opportunities in the park and monument as proposed in the alternatives would be consistent with existing park land uses or local (non-NPS) land use plans, policies, or controls for the area. Therefore, this topic was dismissed from detailed analysis.	Council on Environmental Quality regulations; Director's Order 12 Handbook
Urban Quality and Design of the Built Environment Dismissed	The quality of urban areas would be addressed by design guidelines used to guide new development and the rehabilitation of existing structures, as well as project review processes that the National Park Service has in place, all of which are part of standard operating procedures. Throughout the park and monument, vernacular architecture and compatible design would be considered for new structures built (or modifications to existing structures) under all of the alternatives. Emphasis would be placed	40 CFR 1 502.16

PART 7: THE AFFECTED ENVIRONMENT

Impact Topic (<i>Retained or Dismissed</i> from further analysis)	Rationale	Relevant Law, Regulation, or Policy
	on designs, materials, and colors that blend in and do not detract from the natural and built environment. Consequently, adverse impacts to the quality of urban areas are anticipated to be negligible. Therefore, this topic was dismissed from detailed analysis.	
Environmental Justice Dismissed	<p>Executive Order 12898 requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing the disproportionately high or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. According to the Environmental Protection Agency (EPA), environmental justice is the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.</p> <p>Marin, San Francisco, and San Mateo Counties, where the park and monument are located, contain minority and low-income populations; however, environmental justice is dismissed as an impact topic for the following reasons:</p> <p>NPS staff and planning team actively solicited public participation as part of the planning process and gave equal consideration to input from all persons regardless of age, race, income status, or other socioeconomic or demographic factors.</p> <p>Implementation of any of the alternatives would not result in any disproportionate human health or environmental effects on</p>	Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations"

Impact Topic (Retained or Dismissed from further analysis)	Rationale	Relevant Law, Regulation, or Policy
	<p>minorities or low-income populations and communities.</p> <p>The impacts associated with implementation of the alternatives would not result in any effects that would be specific to any minority or low-income community. Any anticipated impacts, such as traffic, would not disproportionately affect minority or low-income populations.</p>	
Transportation		
Visitor Connections to Park Sites and Communities Retained	Actions included in the plan, such as changes in visitor opportunities and access, as well as improvements to alternative transportation, could result in impacts to visitor connections to park sites and communities. Therefore, this topic was retained for detailed analysis.	National Environmental Policy Act
Functionality of the Transportation System Retained	Actions included in the plan, such as changes in visitor access, alternate modes of transportation, and transportation system assets, could result in impacts to the functionality of the parks' transportation system. Therefore, this topic was retained for detailed analysis.	National Environmental Policy Act
Park Management, Operations, and Facilities		
NPS Operations Facilities Retained	Support facilities necessary to house, transport, inform, and serve visitors and staff require proper planning, design, programming, construction, operation and maintenance. Facilities should be cost-effective, integrate sustainable design, and consider impacts on the landscape, environs, and resources of the park and monument. Actions included in the plan, such as the type and location of NPS operations facilities for maintenance and law enforcement, could result in impacts to NPS operations and management. Therefore, this topic was retained for detailed analysis.	<p>NPS Organic Act; DOI Departmental Manual; NPS <i>Management Policies 2006</i>; Director's Order 80</p>

PART 7: THE AFFECTED ENVIRONMENT

Impact Topic (<i>Retained or Dismissed</i> from further analysis)	Rationale	Relevant Law, Regulation, or Policy
Staffing Retained	Actions included in the plan, such as changes in visitor opportunities, facility use, resource management, and interpretation/education, could result in impacts to NPS staffing. Therefore, this topic was retained for detailed analysis.	NPS Organic Act; DOI Departmental Manual; <i>NPS Management Policies 2006</i> ; Director's Order 80

NATURAL RESOURCES – GOLDEN GATE NATIONAL RECREATION AREA

INTRODUCTION

Golden Gate National Recreation Area is one of the largest urban national parks in the world. The park's 80,500 acres of land and water extend from Tomales Bay in Marin County south into San Mateo County, encompassing 59 miles of bay and ocean shoreline. Golden Gate National Recreation Area is rich in natural resources; it is comprised of 19 separate ecosystems and is home to more than 1,250 plant and animal species. With 80 sensitive, rare, threatened, or endangered species, Golden Gate National Recreation Area ranks fourth among all units in the national park system in the number of federally protected and threatened species found within the park.

Numerous special status designations emphasize the collective importance of Golden Gate National Recreation Area and Point Reyes National Seashore as areas of biological significance. The Nature Conservancy has listed this region as one of the six most biologically significant areas in the United States; it is a biodiversity "hot spot" recognized by The Nature Conservancy and targeted by the global conservation community as key to preserving the world's ecosystems. Conservation International describes this portion of central California as one of the top 25 hotspots and the most threatened of all biologically rich terrestrial regions in the world. Point Reyes National Seashore and Golden Gate National Recreation Area are jointly designated as a Biosphere Reserve, one of 411 reserves designated by the United Nations Educational, Scientific, and Cultural Organization's (UNESCO) Man and the Biosphere Program to provide a global network representing the world's major ecosystem types (NPS 2007a).

Golden Gate National Recreation Area is part of the California Floristic Province (characterized by Mediterranean vegetation) and a zone of overlap of marine provinces (Californian and Oregonian) leading to a wide diversity of terrestrial and aquatic habitats. From the tip of Tomales Point to the southernmost areas of Sweeney Ridge and Phleger Estate, the natural communities of the park support a diversity of habitats: marine environments, coastline, sea cliffs and sand dunes, mud flats and salt marshes, chaparral and coastal scrub, grasslands, redwood forests, and oak woodlands. The recreation area spans two of the largest estuaries on the West Coast: Tomales Bay and San Francisco Bay. Aquatic associated habitats include ephemeral and perennial freshwater streams, groundwater seeps and springs, seasonal wetlands, tidal and brackish saline wetlands grading into estuaries, and the marine environment (NPS 2007a).

ALCATRAZ ISLAND

Alcatraz Island is a unique part of Golden Gate National Recreation Area. Accounts of early explorers describe the island as having little plant life and covered with bird guano. Construction of the Civil War military fort and later the federal penitentiary changed the landscape significantly, sharpening the incline of the cliffs and flattening the slopes. Few plants are native to Alcatraz Island and most of the existing plants are a result of prison

gardens or other means of importation, including soils brought from Angel Island during the fort construction. Since the closure of the prison, many bird species have made the island home.

PHYSICAL RESOURCES

Air Quality

Section 118 of the 1963 Clean Air Act (42 U.S.C. 7401 et seq.) requires a national park unit to meet all federal, state, and local air pollution standards. Golden Gate National Recreation Area and Muir Woods National Monument are in a Class II air quality area under the Clean Air Act, as amended. A Class II designation indicates the maximum allowable increase in concentrations of pollutants over baseline concentrations of sulfur dioxide and particulate matter as specified in Section 163 of the Clean Air Act. Further, the Clean Air Act provides that the federal land manager has an affirmative responsibility to protect air quality-related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse pollution impacts.

The Clean Air Act requires the Environmental Protection Agency to identify national ambient air quality standards to protect public health and welfare. Standards were set for the following pollutants: ozone (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), inhalable particulate matter less than 10 microns (PM₁₀) and less than 2.5 microns (PM_{2.5}), and lead (Pb). These pollutants are designated criteria pollutants because the standards satisfy criteria specified in the act. An area where a standard is exceeded more than three times in three years can be considered a nonattainment area.

The California Clean Air Act of 1988, as amended, sets ambient air quality standards that are stricter than the federal standards and requires local air districts to promulgate and implement rules and regulations to attain those standards. Under the act, California Ambient Air Quality Standards are set for all pollutants covered under national standards, as well as vinyl chloride, hydrogen sulfide, sulfates, and visibility-reducing particulates. If an area does not meet the California standards, it is designated as a state nonattainment area.

In 1993, the Environmental Protection Agency adopted regulations implementing Section 176 of the Clean Air Act as amended. Section 176 requires that federal actions conform to state implementation plans for achieving and maintaining the national standards. Federal actions must not cause or contribute to new violations of any standard, increase the frequency or severity of any existing violation, interfere with timely attainment or maintenance of any standard, delay emission reduction milestones, or contradict state implementation plan requirements. Federal actions that are subject to the general conformity regulations are required to mitigate or fully offset the emissions caused by the action, including both direct and indirect emissions over which the federal agency has some control.

Golden Gate National Recreation Area and Muir Woods National Monument are in the San Francisco Bay Area Air Basin, which consists of San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa, Napa, and Marin counties, as well as portions of Sonoma

and Solano counties. The Bay Area Air Quality Management District is the air quality agency responsible for the entire basin. The agency monitors criteria pollutants continuously at stations throughout the Bay Area.

Overall, air quality in the basin is better than in other urban areas of California despite widespread urbanization and extensive industrial and mobile source (vehicular) emissions. The Bay Area's coastal location and favorable meteorological conditions help keep pollution levels low much of the year, primarily due to the area's relatively cooler temperatures and better ventilation. However, when temperatures are hot and there are no ocean breezes, levels of ozone and other pollutants can exceed federal and state air quality standards.

The San Francisco Bay Area is designated a federal nonattainment area for ozone and a state nonattainment area for ozone and inhalable particulate matter (PM₁₀ and PM_{2.5}). Ozone is a principal component of smog. It is caused by the photochemical reaction of ozone precursors (reactive organic compounds and nitrogen oxides). Ozone levels are highest in the Bay Area during days in late spring through summer when meteorological conditions are favorable for the photochemical reactions to occur, i.e., clear warm days and light winds.

An air emissions inventory was conducted in 1999 to determine the origins, compositions, and rates of emission of pollutants affecting park lands and resources. In addition to Golden Gate National Recreation Area activities, the inventory included air emissions associated with park partners and concession operations and visitor activities to the extent that data were available. Standardized emission factors and air quality models from the California Air Resources Board and the Environmental Protection Agency were used to develop emission levels for the range of activities and facilities that can emit pollutants in Golden Gate National Recreation Area (NPS 2005a).

Sources of air emission within Golden Gate National Recreation Area include all three types identified by the Clean Air Act: stationary sources, area sources, and mobile sources. Stationary sources can include fossil-fuel-fired space and water heating equipment, backup generators, fuel storage tanks, paint and chemical usage, and woodworking equipment. Area sources may include prescribed burning, campfires, and bonfires. Mobile sources may include vehicles and other equipment operated within the park by visitors, tour operators, Golden Gate National Recreation Area employees, and concession employees.

The emissions inventory included all lands and uses within the GMP planning area. Included in the inventory were all structures, vehicles, boats, and equipment used by the park, park partners, or concessions, such as the Hornblower that operates the ferry service to Alcatraz Island.

Table 2: County Variation in Attainment Status, Demonstrated by Monitoring Station Data, 2001-2003

Pollutant	Redwood City San Mateo County		San Francisco San Francisco County		San Rafael Marin County	
	State Standard	Federal Standard	State Standard	Federal Standard	State Standard	Federal Standard
Ozone (1-hour)*	N	NA	A	NA	A	NA
Ozone (8-hour)	NA	NA	NA	NA	NA	NA
Carbon monoxide	A	A	A	A	A	A
Nitrogen dioxide	A	A	A	A	A	A
Sulfur dioxide	ND	ND	A	A	ND	ND
Particulate matter (PM ₁₀) (Max. 24-hour)	NA	A	N	A	NA	A

Source: Bay Area Air Quality Management District Annual Bay Area Air Quality Summary

Notes:

A = Attainment, N = Nonattainment, U = Unclassified, NA = Not Applicable, ND = No data

*Attainment status is assigned only on an air-basin level. Though specific county monitors indicate attainment with NAAQS, all counties are included in the San Francisco Bay Area Air Basin, which is designated as nonattainment for 1-hour and 8-hour ozone national standards and for state standards for PM₁₀.

There are no air quality monitoring stations in operation for the coastal areas of the Bay Area Air Basin that are certain to represent air quality conditions within the park. A monitoring station at Fort Cronkhite in the Marin Headlands records levels of toxins present in the air as a by-product of manufacturing, such as acetone and benzene, and does not monitor for criteria pollutants. The closest monitoring stations to park lands that record levels of criteria pollutants are in the cities of San Rafael, Redwood City, and eastern San Francisco. The levels recorded at these stations, which are located in the midst of urban development, would be more representative of the cumulative levels of air pollutants in urbanized areas that contain heavily used roadways, urban and residential sources, and existing stationary sources throughout the air basin. Data collected at these stations can serve as very conservative estimates of ambient air quality affecting the park lands, which are largely coastal and generally upwind (based on prevailing wind direction) of local sources of Bay Area air emissions, but are still subject to pollutant problems, such as ozone, that have a more regional effect on air quality. However, the actual ambient pollutant concentrations within the park lands are anticipated to have lower background levels of these pollutants because the project area and surroundings are more remote and generally upwind of roadways and other emission sources (NPS 2005a).

Carbon Footprint

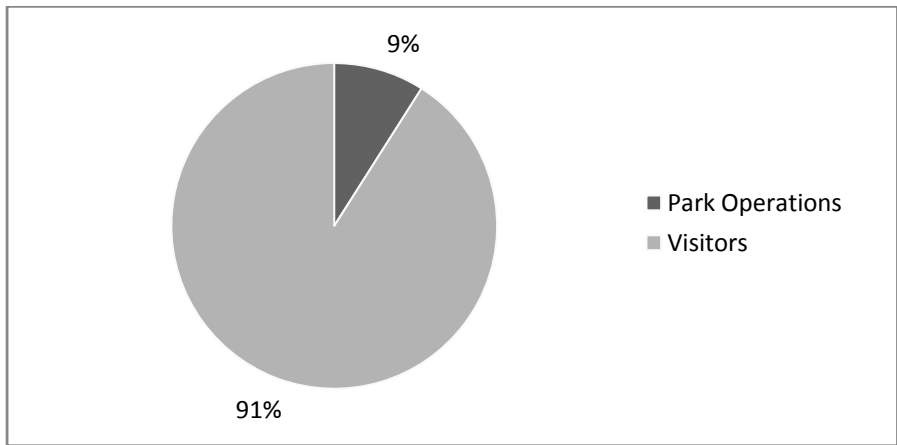
A “carbon footprint” is a measure of the impact human activities have on the environment in terms of the amount of greenhouse gases produced, and is measured in units of carbon dioxide. The greenhouse effect is a natural phenomenon that keeps the earth’s temperature stable at an average of 60° F. Without this natural warming effect, our planet would be uninhabitable at an average temperature of 14° F. However, human actions are disturbing this balance through over-production of large amounts of two main greenhouse gases, carbon dioxide (CO₂) and methane (CH₄). The increase in greenhouse gases is causing an overall warming of the planet, commonly referred to as *global warming*. The term *climate change* describes the variable consequences of global warming over time.

The National Park Service has a goal of reducing its contribution to global warming and climate change through the reduction of emissions. To begin tracking the results of their efforts, the park staff inventoried its emissions in 2006 using the Climate Leadership in Parks (CLIP) tool developed by the National Park Service and the Environmental Protection Agency. The CLIP tool converts emissions of various greenhouse gases into a common “metric tons of carbon equivalent” (MTCE) unit, which provides a basis for comparison among gases and simplifies reduction tracking. The conversion of a greenhouse gas to an MTCE unit is based on how strongly that particular gas contributes to the greenhouse effect, and how many tons of carbon emission would have the same effect.

The emissions inventory (NPS 2007c) then looked at the relative input of various sectors: stationary combustion (building furnaces, dryers, electrical generators, hot water heaters), purchased electricity, mobile combustion (vehicles, buses, heavy equipment), wastewater treatment, and solid waste disposal (garbage transportation and decomposition) for Golden Gate National Recreation Area and Muir Woods National Monument. Based on the emissions inventory completed in 2006, emissions from visitors (mobile combustion primarily from personal automobile use) represents 91% of gross emissions and emissions from park operations represents 9% (see figure 1). Figure 2 shows how the National Park Service’s emissions from park operational activities are distributed among sectors when visitor emissions are excluded.

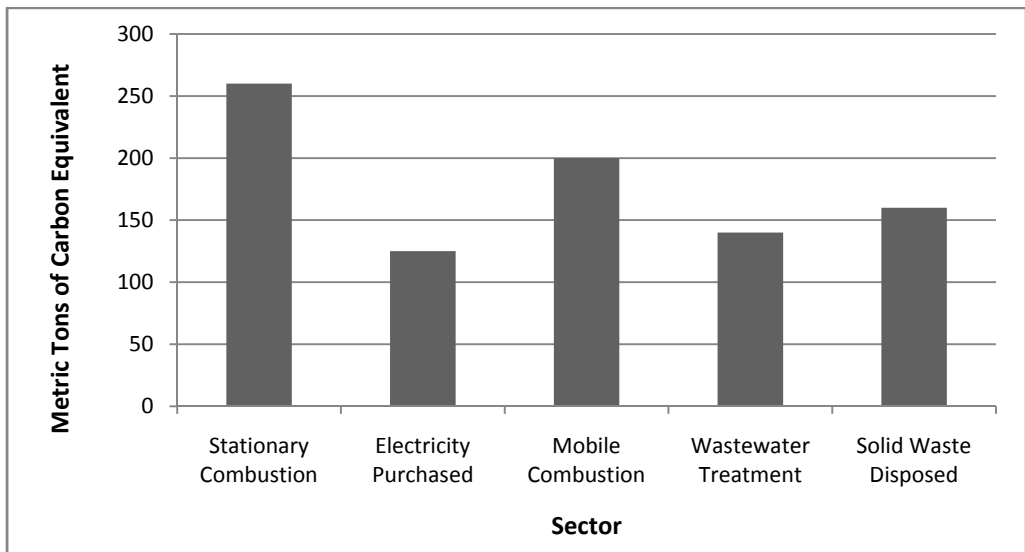
Visitor emission totals consist of an approximation of how much gasoline is consumed while driving to various park locations. Using annual visitor vehicle counts to many of the different locations in the park, the total number of miles driven by visitors was approximated (based on the assumption that they were driving from somewhere in the Bay Area). The resulting total vehicle miles driven by visitors was put into the CLIP tool. The CLIP tool then used assumptions about the different types of cars and the miles per gallon capacity of each to determine approximate fuel consumption.

Figure 1: Gross Emissions for Golden Gate National Recreation Area



Source: *Climate Change Action Plan for Golden Gate National Recreation Area*, August 2007

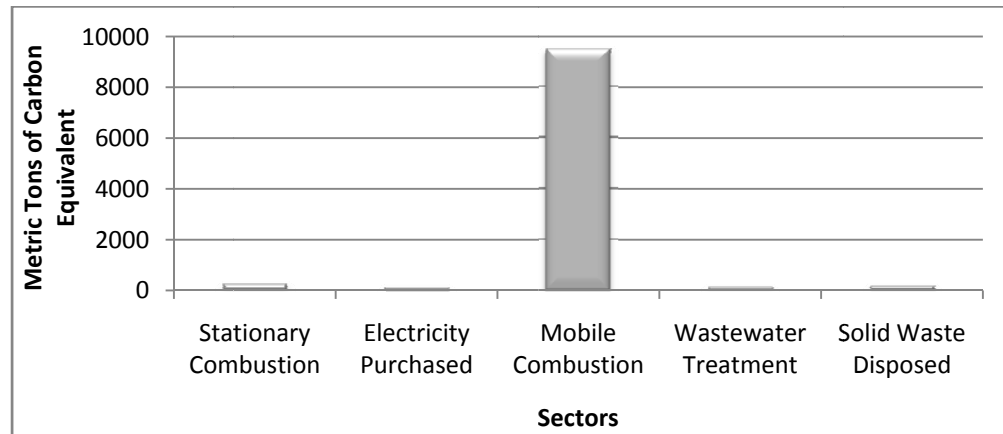
Figure 2: 2006 Gross Park Emissions by Sector, Excluding Visitors



Source: *Climate Change Action Plan for Golden Gate National Recreation Area*, August 2007

Figure 3 shows how the sectors of emissions are distributed when visitor emissions are included. The vast majority of emissions at Golden Gate National Recreation Area are attributable to visitor mobile combustion (vehicles).

Figure 3: 2006 Gross Park Emissions by Sector, Including Visitors



Source: *Climate Change Action Plan for Golden Gate National Recreation Area*, August 2007

In 2008, Golden Gate National Recreation Area's emissions inventory was updated and included the following emissions statistics for Golden Gate National Recreation Area (including park lands in the three-county area and Alcatraz Island) and Muir Woods National Monument. These data represent existing baseline conditions.

Table 3: Emission Statistics for Golden Gate National Recreation Area

	Marin County	San Francisco County	San Mateo County	Alcatraz Island	Muir Woods
Statutory combustion	523	148	No Data Available	632	5
Purchased electricity	385	382	No Data Available	0	17
Mobile combustion	1047	1419	No Data Available	1167	4873
Wastewater treatment	263	0	No Data Available	31	1
Solid waste	332	472	No Data Available	0	50
Gross emissions	2551	2422	No Data Available	1830	4946

Soils and Geologic Resources and Processes

Geology

The majority of the lands within Golden Gate National Recreation Area are located on the North American Tectonic plate. The more recently acquired lands in San Mateo are located on the Pacific plate. The boundary between these two plates is a transform fault (the plates are sliding past each other) and is formed by what is perhaps the best known geologic feature of California: the San Andreas fault zone. Movement along the San Andreas and its subsidiary faults, the Hayward and Calaveras, is infamous for producing the large earthquakes that periodically shake California and result in the area's rugged terrain. Older rocks of coastal California indicate that, before the Pacific Plate started slipping northward past the North American Plate on the San Andreas fault system, the Pacific ocean floor was subducted (moved) beneath the western edge of the North American Plate. The distinctive rocks of the world-famous Franciscan Complex, named at San Francisco and underlying much of coastal Northern California, formed in this subduction zone.

In the Bay Area, rocks of the Franciscan Complex form the basement for the Coast Ranges east of the San Andreas Fault. The Franciscan primarily consists of graywacke sandstone and argillite, but also contains lesser amounts of greenstone (altered submarine basalt), radiolarian ribbon chert, limestone, serpentinite (altered mantle material), and a variety of high-grade metamorphic rocks such as blueschist (high-pressure), amphibolites and eclogite (high-temperature). These rocks are typically highly fractured and disrupted and may be mixed together on a local scale to create what is called a *mélange* (French for "mixture" or "blend").

Because serpentinite is altered mantle rock, its chemistry is unlike most other continental rocks. Serpentinite is low in potassium and calcium, which are important plant nutrients. It also contains high levels of magnesium, nickel, and chromium that are potentially toxic to plants. Therefore, plants living on serpentine soils are specially adapted to these unusual chemical conditions, and serpentinite areas can often be mapped based on the abrupt vegetation change that occurs at their boundaries.

Serpentinite outcrops in California and throughout the world are known to support rare and endangered plant species (Kruckenberg 1984). Some species are confined to just one or a few outcrop areas. Eight of the twelve rare plants found at the Presidio grow on serpentinite, including the federally endangered Presidio clarkia and Raven's manzanita. (Elder n.d.)

Soils

Most of the soils within Golden Gate National Recreation Area belong to the following complexes: Blucher-Cole, Centissima-Barnabe, Cronkhite-Barnabe, Dipsea-Barnabe, Felton Variant-SoulaJule, Franciscan, Gilroy-Gilroy Variant-Bonnydoon Variant, Henneke stony clay loam, Kehoe, Rodeo Clay Loam, and Tamalpais-Barnabe Variant (USDA, Soil Surveys for Marin, San Francisco, and San Mateo counties). All of these soils are susceptible to sheet and rill erosion when disturbed or exposed. The susceptibility to wind erosion is generally low. In general, these soils are characterized by slow to moderate permeability, rapid stormwater runoff, and a high hazard of soil erosion, soil creep, and occasional land sliding. An aerial view of the park area landscape

makes clear the threats posed by erosion. Coastal waves rhythmically crash against the shoreline; deep, long gullies originate at old roads; heavily used areas are devoid of vegetation; undesignated social trails crisscross through the natural areas; and landslides or slumps exist in the small valleys (NPS 2005a).

Alcatraz Island is composed of consolidated sandstone sediments, and is the remainder of a mountain that has been highly eroded. Much of the soil on the island is a result of importation from Angel Island during the fort construction or soil amendments added over the years to support the various gardens and landscape areas.

Paleontological Resources

Fossils of tropical and subtropical species of zooplankton (radiolarian) have been found in chert of the Marin Headlands. Mollusk fossils (ammonite, belemnite, bivalve) have also been found here. Bivalve mollusk fossils are found on Alcatraz Island, and Mori Point is a source of zooplankton (radiolarian, foraminifera). The area near Devil's Slide includes zooplankton (foraminifera), mollusk (gastropod, bivalve), crustacean, and sea star-like (echinoid) fossils. Fort Funston includes mollusk (gastropod, bivalve), sand dollar, crustacean, marine worm (polychaete), woolly mammoth, giant ground sloth, mastodon, horse, camel, canid and split-toed ungulate fossils. Fossils found on the Phleger Estate include mollusk (freshwater gastropod, bivalve), unnamed vertebrates, and plants.

Shoreline Processes

The park's coastal shoreline along the Marin Headlands, Golden Gate Strait, and San Francisco peninsula comprise a diverse mixture of rocky shorelines, fine-grained sand beaches, and artificial structures (e.g., piers), as well as sites with a mixture of fine-grained and larger substrates. As the name implies, the Marin Headlands are steep rocky headlands such as Tennessee Point and Point Bonita that are unprotected and exposed to high wave erosion and strong currents. In sheltered areas, large beaches, such as Rodeo and Muir beaches, form bars that create lagoonal features behind them. Small pocket beaches are often characterized by steep slopes and a mixture of small and large substrates. The Golden Gate strait is characterized by rocky headlands, smaller sand and gravel beaches, and strong tidal currents. Within the Golden Gate strait, the shorelines have a higher percentage of artificial structures such as rubble breakwaters (Fort Baker), seawalls (Alcatraz, Fort Point, and Presidio), piers, and riprap bank protection. Much of the San Francisco peninsula shoreline within the park is dominated by Ocean Beach, the park's largest sand beach resource (NPS 2007a).

Alcatraz Island is composed of fractured sandstone and is somewhat susceptible to wave-generated erosion.

Sea Level Rise and Coastal Vulnerability

While the effect of climate change on sea level has shocking global implications of inundating low-lying islands and threatening coastal cities and harbors, it also raises serious concerns for many U.S. national parks. Golden Gate National Recreation Area is

no exception, given its extensive shorelines along the Pacific Ocean and San Francisco Bay. Although there is general consensus in the scientific community that notable sea level rise will occur over the next 100 years, the predicted degree of sea level rise varies considerably depending on which assumptions are incorporated into the prediction. For example, scientists who factor in the melting of the Greenland ice sheets predict that sea levels could rise 13 to 20 feet (approx. four to six meters) over the next 100 years as a result of global warming (Overpeck et al. 2006). If this occurs, the coastal areas of the park and the Bay Area will experience extraordinary change. This prediction is probably at the upper end of the range of sea level rise forecasts.

Other sea level rise projections incorporate only a partial contribution from the melting of the Greenland and Antarctic ice sheets. The Intergovernmental Panel on Climate Change (IPCC) is an international scientific body established by the United Nations Environment Programme and the World Meteorological Organization to provide a scientific view of the current state of climate change and its effects. In its latest assessment report, *Climate Change 2007*, the IPCC indicated that sea level rise by the year 2100 could range from 0.18 to 0.59 meters (seven inches to about 2 feet), depending on the climate change scenario that occurs over this time (IPCC 2007). However, the IPCC report was very clear in noting that these projections do not factor in uncertainties in climate-carbon cycle feedbacks nor the full effects of changes in ice sheet flow or melting. Therefore, the report states that the upper value of this range should not be considered the potential upper bounds for sea level rise (IPCC 2007).

More recent research was conducted for the California Energy Commission's Climate Change Research Program to assess the effects of climate change and sea level rise on California over the next 90 years. Using a set of climate change scenarios of medium to medium-high emissions, researchers projected that the mean sea level will rise 1.0 to 1.4 meters (3.3 to 4.6 feet) along California's coast by the year 2100 (Cayan et. al. 2009, Heberger et. al. 2009). This is the most commonly used sea level rise forecast in the park's planning area. However, these respective climate change reports quickly clarify that most climate models do not include ice-melt contributions from the Greenland and Antarctic ice sheets. Thus, the potential sea level rise could be much higher than these figures (Heberger et al. 2009).

Predictions of sea level rise are useful in determining what resources and facilities could be affected. Figure 4 illustrates the likely effect of the projected 1.4 meter sea level rise on the coastal corridors of the park by combining the effects of the sea level rise with a modeled 100-year flood (Heberger et al. 2009).

Also, the U.S. Geological Survey, in cooperation with the National Park Service, completed an assessment in 2005 (Pendleton, Thieler, and Williams 2005) of Golden Gate National Recreation Area's vulnerability to sea level rise using a tool called the Coastal Vulnerability Index. The Coastal Vulnerability Index provides insight into the relative potential of coastal change due to future sea level rise.

The Coastal Vulnerability Index allows six variables (geomorphology, shoreline change, regional coastal slope, relative sea level rise, mean significant wave height, and mean tidal range) to be related in a quantifiable manner that expresses the relative vulnerability of the coast to physical changes due to future sea level rise. The index highlights those regions where the physical effects of sea level rise might be the greatest.

Sea Level Rise: Golden Gate National Recreation Area



The most influential variables in the Coastal Vulnerability Index are geomorphology, coastal slope, and mean significant wave height; therefore, these may be considered the dominant factors controlling how Golden Gate National Recreation Area will evolve as sea level rises.

While climate change data reflect long-term increases in sea levels, there may be specific sites within Golden Gate National Recreation Area that could be more vulnerable to rising sea levels even within the lifespan of this general management plan, particularly if the melting of the polar ice caps increases more rapidly than expected.

The colored shoreline depicted in figure 5 represents the relative Coastal Vulnerability Index determined from the six variables. The very high vulnerability shoreline is generally located along sandy beaches where significant wave heights are highest and regional coastal slope is shallow; these areas include sites like Ocean Beach, Fort Mason, Land's End, and Fort Funston. The lower vulnerability shoreline is located along rock cliffs mostly along the northern part of Golden Gate National Recreation Area where wave heights are lower and coastal slope is steep.

Of the 59 miles evaluated at the park, 50% of them were classified as having high (26%) or very high (24%) vulnerability, with another 26% classified as having moderate vulnerability (Pendleton, Thieler and Williams 2005). This information raises serious concern, because the most vulnerable shorelines are located on the southern peninsula where the largest concentration of humans and built facilities exist. This area also includes heavily visited beaches such as Ocean Beach, China Beach, and Baker Beach.

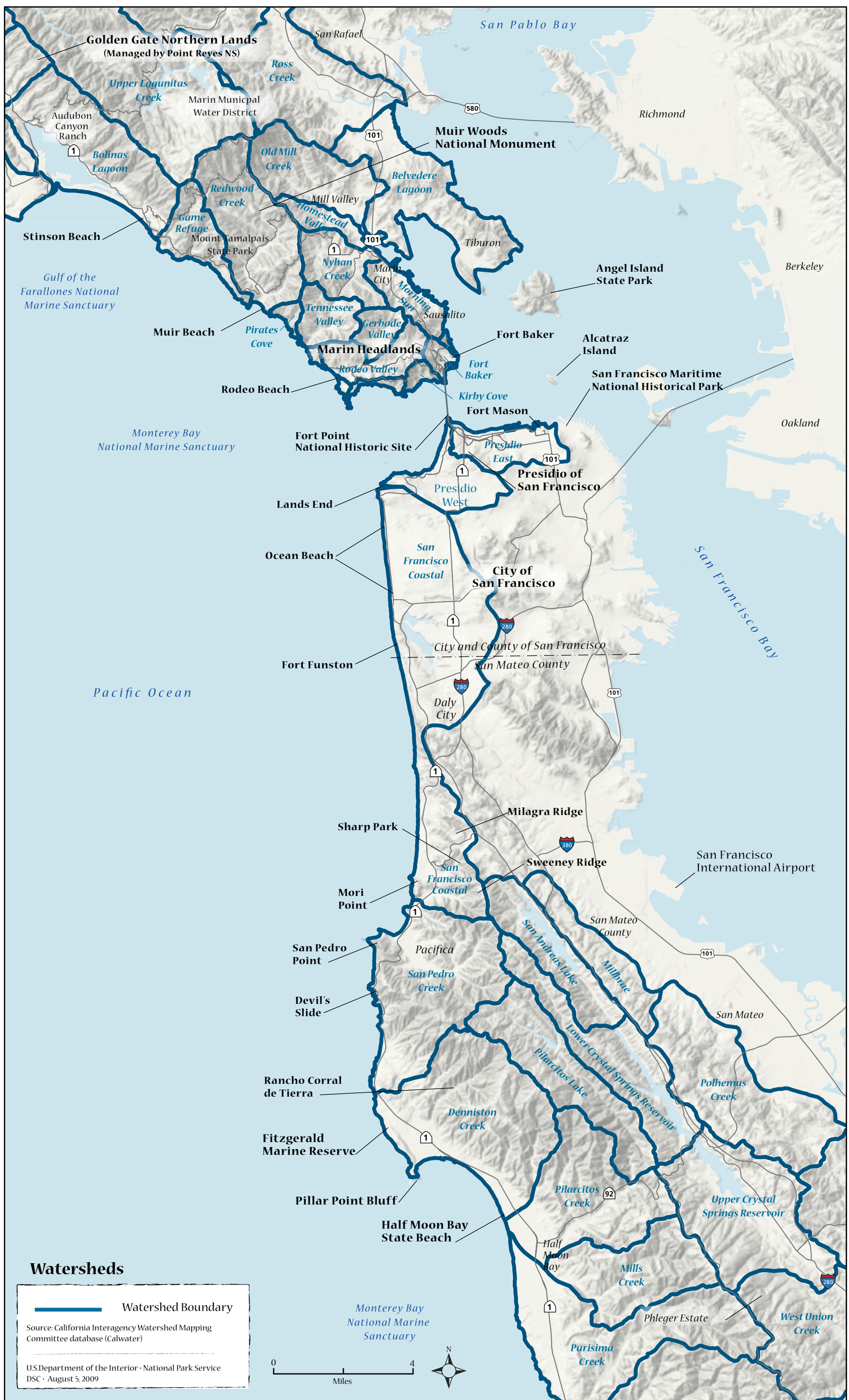
Water Resources and Hydrologic Processes

Water resources in Golden Gate National Recreation Area include springs, streams, ponds, lakes, wetlands, lagoons, the San Francisco Bay, and the Pacific Ocean. Many significant watersheds are located wholly or partially within the park. From north to south, the major watersheds are Bolinas Lagoon, Redwood Creek, Tennessee Valley (Elk Creek), Rodeo Lagoon (including Gerbode Valley subwatershed), Nyhan Creek, Lobos Creek, Milagra and Sweeney Ridges, San Pedro Creek, West Union Creek, San Pedro Creek, Martini Creek, Denniston Creek, San Vicente Creek, and the San Francisco watershed lands in San Mateo County (see figure 6). Many smaller watersheds drain the steep coastal bluffs directly into the San Francisco Bay or Pacific Ocean.

The National Park Service has been monitoring water quality and quantity in varying degrees within these aquatic systems. Most water quality sampling to date has focused on specific sites with known or suspected water quality impacts, including beach water quality monitoring. The National Park Service is presently designing a more comprehensive monitoring program that should identify any existing impacts and serve as baseline data to determine future impacts. For the lands in the southern part of the park (San Francisco and San Mateo counties), this work will also include an inventory of the largely unknown water resources. The monitoring will be coordinated through the San Francisco Bay Area network of regional national park sites (NPS 2005b). The National Park Service is currently participating in a streamflow monitoring program with stations on Lobos Creek, Redwood Creek, and Easkoot Creek.

Figure 5: Coastal Vulnerability





Freshwater Resources

Surface Water

Watersheds in southern Marin County, such as Rodeo Lagoon and Tennessee Valley, are dominated by scrub and grassland vegetation with the majority of the trees in the riparian zone. These watersheds also have extensive stream and wetland complexes throughout their valley floors. Other watersheds, such as the Redwood Creek watershed, Bolinas Lagoon watershed, and the San Pedro Creek watershed, have denser forests beyond the riparian zone. These watersheds have steeper slopes and narrower valleys, and thus restrict the extent of wetlands (NPS 2005a).

Freshwater resources include streams, lakes, and freshwater wetlands. Most of the streams in the park are not large and their tributaries are frequently ephemeral. The overall condition of these resources results from more than a century of intensive human uses, combined with the instability associated with soil types and the highly active San Andreas Fault. The effects of past land use practices (development, logging, agriculture, and grazing) have changed watershed conditions and reduced habitat for many aquatic invertebrates, fish, and amphibians. Loss of native perennial vegetation, soil compaction and loss, hillside trailing, gulying, and incision of swales and meadows have changed the runoff patterns and reduced the capacity of the watershed to attenuate pollutant loading and surface runoff to streams. Dam construction, channelization, water diversions, and the increased water demands of growing urban areas have impaired fish passage, reduced available habitats, and reduced streamflows during summer-fall of dry years. Although land use practices having lesser impacts are being increasingly adopted by landowners, present land use continues to influence water quality conditions within many watersheds (NPS 2007a).

Macroinvertebrates are commonly used as indicators of water quality and functional status of freshwater streams, but to date macroinvertebrate sampling has been infrequent and inconsistent across sites. Coho salmon have been more consistently monitored and their use as an indicator of stream condition is being evaluated (NPS 2007a).

Ponds and swales are also extremely important aquatic resources. As mentioned earlier, some of the largest endangered red-legged frog populations are in Point Reyes National Seashore and northern Golden Gate National Recreation Area where there are more than 120 breeding sites with a total adult population of several thousand frogs. Most of the breeding sites are artificial stock ponds constructed on lands that have been grazed by cattle for 150 years. There are also fairly large populations in some of the coastal drainages in San Mateo County just south of San Francisco in Golden Gate National Recreation Area (NPS 2007a).

The U.S. Geological Survey also monitored sediment and stream flow in Audubon Canyon and Morses Creek (near Bolinas) between 1967 and 1969. University of California Berkeley staff monitored Lone Tree Creek (south of Stinson Beach) between 1972 and 1974. Stream gauges were installed by the National Park Service at Redwood Creek (State Route 1 Bridge) and Easkoot Creek. Because of high toxic nutrient loads, algal blooms have occurred in Rodeo Lagoon. In addition to nutrient issues, Rodeo Lagoon sediments may contain elevated amounts of copper from copper sulfate (algaecide) treatment. Rodeo Lagoon sediments may contain elevated amounts of metals from past and current activities (NPS 2005a).

Due to its relatively small size, Alcatraz Island does not have streams—only ephemeral drainages that flow during rainfall.

Marin County Watersheds. Most Marin County watersheds drain to the Pacific Ocean. watersheds relevant to park lands include Bolinas Lagoon, Redwood Creek, Marin Highlands, and others. The Bolinas Lagoon watershed extends from the Bolinas Ridges west to Inverness Ridge. Two-thirds of this watershed is in public ownership. Streams within this watershed are steep and flow through the highly erodible Franciscan Complex. The Redwood Creek watershed extends from the peaks of Mount Tamalpais, through Muir Woods National Monument, to the Pacific Ocean at Muir Beach. Ninety-five percent of the watershed is owned and managed by public agencies. Several threatened animal species also occur in the watershed, including coho salmon, steelhead, California red-legged frog, and the northern spotted owl (*Strix occidentalis caurina*).

In addition to draining into the Pacific Ocean and San Francisco Bay, the Marin Headlands drain into Rodeo Lagoon, which provides marine habitat, water recreation, saltwater habitat, and wildlife habitat. Rodeo Lagoon is a significant wetland/estuarine resource that provides important habitat for marine birds and other species including red-legged frog and tidewater goby (NPS 2005a).

San Francisco City and County Watersheds. The majority of the watersheds in San Francisco are highly urbanized, and their boundaries have been modified by storm drainage projects and other urban infrastructure. The Park Service manages lands in San Francisco draining to San Francisco Bay, the Golden Gate Channel, and the Pacific Ocean. Tennessee Hollow and Lobos Creek, both of which are within Golden Gate National Recreation Area and the Presidio of San Francisco (Presidio), remain in a relatively nonurban state and are significant water resources in the park. The Tennessee Hollow stream, in the Presidio East watershed, is the main fresh water source for the Crissy Field marsh, a recently completed wetland restoration project. Lobos Creek, in the Presidio West watershed, is the main water supply for the Presidio (NPS 2005a). Although small, this spring-fed creek has the highest summer baseflows in the park.

San Mateo County Watersheds. The watersheds in San Mateo County have not been comprehensively studied due to piecemeal land management by various agencies and private holdings. The watersheds that wholly or partly contain park land include Milagra, between Sweeney and Milagra; Sweeney; San Pedro Creek; Crystal Springs (part of the larger San Francisco watershed); and West Union / San Francisquito Creek. The 23-square-mile San Francisco watershed is owned and managed by the San Francisco Public Utilities Commission and is part of the water supply storage for the City and County of San Francisco. This watershed includes San Andreas Lake, Crystal Springs, Pilarcitos Lake, and a portion of the Pilarcitos Creek watershed. The San Pedro Creek watershed drains portions of the San Francisco watershed lands, Picardo Ranch, and portions of Devil's Slide. The West Union Creek watershed contains a tributary to the Searsville Lake that drains the Phleger Estate at the south end of Golden Gate National Recreation Area (NPS 2005a).

Groundwater

Marin County. The underlying Franciscan bedrock is relatively impermeable in Marin County, creating a perched water table. Numerous springs throughout the watershed feed Rodeo Creek well into the summer months. The total volume of water stored in the aquifer is unknown. No wells are in operation within NPS-managed lands in Marin

County. The water table is tidally influenced in the lower areas such as Fort Baker (NPS 2007b).

San Francisco County. Groundwater sources in San Francisco County are made up of shallow unconsolidated alluvium underlain by less permeable bedrock of the Franciscan Complex. Average precipitation is approximately 24 inches per year, but due to high impervious cover rates, little infiltration occurs. The primary water-bearing formations are comprised of unconsolidated sediments and include alluvial fan deposits, beach and dune sands, undifferentiated alluvium, and artificial fill. Groundwater within San Francisco County is subject to high concentrations of nitrates and elevated chloride, boron, and total dissolved solids concentrations. High nitrate levels are attributed to groundwater recharge from sewer pipe leakage and possibly to fertilizer introduced by irrigation return flows. Elevated chloride and total dissolved solids levels are most likely due to a combination of leaky sewer pipes, historic and current seawater intrusion, and connate water. Current groundwater usage in the City of San Francisco is primarily for irrigation of parks and golf courses.

San Mateo County. Much of San Mateo County is part of the Santa Clara Valley Groundwater Basin, with portions in the San Francisco basin. Santa Clara Valley groundwater sources include coastal marine terrace or stream valley alluvial deposits where groundwater is stored in loose, unconsolidated, coarse-grained sand, and upland granitic bedrock of the Santa Clara Formation, where groundwater is stored in weathered rock openings and in rock fractures. The granite bedrock has limited storage capacity, but the alluvial deposits are good sources of groundwater. Over the long term, the marine terraces appear to be in hydrological balance; however, in dry years, pumping has reduced the water table to near sea level—increasing the risk of salt water intrusion. The water is slightly alkaline with a mean pH value of 7.3 based on 20 samples. Hardness for the 20 wells sampled averaged 471 milligrams per liter (mg/L) as calcium carbonate (CaCO_3), in excess of the 180 mg/L minimum value for water to be classified as very hard (CWA 2004).

Floodplains

Floodplains exist along streams and creeks throughout Golden Gate National Recreation Area and Muir Woods National Monument. In Marin County, 100-year floodplains are located along Redwood Creek and Rodeo Creek. Park facilities at Stinson Beach (parking lots and picnic areas) and Muir Beach (parking lot and Pacific Way) are in the 100-year floodplain.

In San Mateo County, 100-year floodplains are located along Denniston Creek, San Vicente Creek, and the Middle Fork of San Pedro Creek. The lower stables at the Rancho Corral de Tierra property are located in the San Vicente Creek 100-year floodplain.

Water Quality

The size and nature of the park (including high visitor use, the urban interface, and multitude of land uses) create several issues related to water quality. Accelerated erosion due to roads, trails, and other uses and developments threatens the sediment balance and ecological health of several watersheds. Grazing is no longer allowed on NPS-managed lands in Golden Gate National Recreation Area (NPS 1999b), but some of the impacts remain. Bacteria and nutrient inputs from equestrian operations, pet waste, agricultural operations, and potentially from sewer and septic systems can affect wildlife and public health as well as the overall ecological balance of water resources. Alteration of channels

(including dams and culverts) affects the ecological health of park watersheds. These primary issues occur to varying extents within multiple park watersheds (NPS 2005a).

Many park water quality issues are related to facilities and structures. A roads and trails inventory exists and many structures are documented in the maintenance division's facilities database. However, a comprehensive inventory of park facilities and structures (including dams, culverts, and outfalls) has not been conducted (NPS 2005a).

Work is in progress to document facilities, roads and trails, and other water quality threats more thoroughly. For example, for the Redwood Creek watershed, a sediment budget study and a report of all sediment sources in the watershed were completed. Trail maps are being updated for the park and erosion surveys continue throughout the Marin Headlands. A dam inventory will be included in an upcoming "Water Quality Data Inventory and Analysis Report." Culvert mapping has occurred in Rodeo Valley (NPS 2005a).

Golden Gate National Recreation Area has a long history of water quality problems due to its proximity to urban and rural land uses. The park's surface waters and groundwater provide important beneficial uses that serve as a basis for establishing water quality objectives and discharge prohibitions by the California State Water Quality Control Board and the Environmental Protection Agency (EPA). These "beneficial" uses include agricultural supply, cold freshwater habitat, fish migration, municipal and domestic water supply, preservation of rare and endangered species, contact water recreation, noncontact water recreation, shellfish harvesting, fish spawning, warm freshwater habitat, and wildlife habitat. Additional beneficial uses for the Pacific Ocean include commercial and sport fishing, industrial service supply, and marine habitat. Some of the external issues facing the park have to do with balancing the historical and cultural traditions of ranching and dairy establishments with the very high water quality needed for endangered species such as coho salmon, steelhead trout, California freshwater shrimp, and California red-legged frogs. In the park, particularly in areas south of the Golden Gate, the primary issues are stormwater discharge and legacy contaminants from abandoned military installations (NPS 2007a).

According to the California State Water Quality Control Board, eight areas (three creeks, three bays, and two beaches within the park) are listed as impaired according to the EPA's list of impaired waters (the 303d List) (see table 3). The San Francisco Regional Water Quality Control Board has established a timeline for the development of total maximum daily loads associated with the highest priority impairment listings. The National Park Service is currently working with the state and local agencies to develop and implement monitoring and enhancement efforts to address additional impairment issues. Additional water quality programs are associated with the three counties within Region 2: Marin, San Francisco, and San Mateo. Water districts and some watershed groups also monitor water quality (NPS 2007a). Water quality monitoring in coastal areas at Rancho Corral De Tierra has also been done by San Mateo County Resources District (Critical Coastal Areas) through volunteers and tenants over the years.

Near-shore water quality has rarely been monitored by the parks, while freshwater and beach resources are measured principally in areas where problems have been identified. This lack of a probabilistic (randomized) water sampling program means that generalizations should be made with care; a broad summary of park water quality, or

even watershed water quality, is likely to overstate problems and overemphasize freshwater resources (NPS 2007a).

Marin Headlands / Redwood Creek / Stinson Beach / Bolinas Lagoon Areas. Short-term data sets also exist for Rodeo Creek and Tennessee Valley (1994–1996). Rodeo Creek and Tennessee Valley were monitored along with Green Gulch between 1998 and 2001 as part of intensive sampling related to stable operations and other potential sources of bacteria and nutrients. Parameters typically monitored included flow (though flow data has been sporadic), pH, temperature, dissolved oxygen, conductivity, biochemical oxygen demand (BOD), salinity, total suspended solids (TSS), fecal and total coliforms, nitrates, ammonia, phosphates, total phosphorus (Total P), metals (emphasis on copper), methylene blue active substance (MBAS), and chloride. Not all parameters were monitored at all sites (NPS 2005a).

Water quality monitoring has been conducted in Redwood Creek and tributaries (including Kent Creek, Camino del Canyon, Banducci Tributary, Green Gulch, and Golden Gate Dairy Tributary) at numerous locations throughout the years. Several data sets exist for discrete (i.e., short-term, focused) monitoring projects. For example, monitoring by the National Park Service in the Redwood Creek watershed was conducted in 1986, 1988, 1990 to 1991, and 1993 to 1996. Much of the water quality monitoring within the park has focused on lower Redwood Creek due to concerns related to nutrient and bacteria inputs in this locale, including recent data related to the Golden Gate Dairy and Big Lagoon (NPS 2005a).

The U.S. Geological Survey also monitored sediment and stream flow in Audubon Canyon and Morses Creek (near Bolinas) between 1967 and 1969. UC Berkeley monitored Lone Tree Creek (south of Stinson Beach) between 1972 and 1974. Stream gauges were installed by the National Park Service at Redwood Creek (State Route 1 Bridge) and Easkoot Creek (NPS 2005a).

Consultants, universities, the U.S. Geological Survey, and other entities have also conducted monitoring. For example, the Stinson Beach County Water Agency currently monitors Easkoot Creek for fecal coliform bacteria. Limited monitoring has been conducted in Oakwood Valley and Nyhan Creek as part of an overall stormwater monitoring project that includes Redwood Creek, Tennessee Valley, and Rodeo Creek (NPS 2005a).

Flow monitoring by various entities, including the National Park Service, the U.S. Geological Survey, local universities, and consultants, has also been conducted. Flow monitoring sites have typically corresponded with water quality monitoring sites and include the Redwood Creek watershed (including Camino del Canyon, Kent Creek, Banducci Tributary, and Green Gulch Creek) as well as Easkoot Creek, Rodeo Creek, and Tennessee Valley.

Table 4: Impaired Water Bodies within Point Reyes National Seashore and Golden Gate National Recreation Area as Indicated from the 2006 303d List

Water Body	Park Unit	Pollutant
Lagunitas Creek	Point Reyes NS, Golden Gate NRA	Sediment, Nutrients
Richardson Bay*	Golden Gate NRA	High Coliform, Chlordane, DDT, Dieldrin, Dioxin, Furan compounds, Mercury, Polychlorinated Biphenyls (PCBs), Exotic Species
San Francisco Bay	Golden Gate NRA	Chlordane, DDT, Dieldrin, Mercury, PCBs, Polycyclic Aromatic Hydrocarbon (PAHs), Nickel, Furan compounds, Exotic Species, Dioxin, Selenium
San Francisquito Creek	Golden Gate NRA	Sediment
San Pedro Creek	Golden Gate NRA	High Coliform
Tomales Bay	Point Reyes NS, Golden Gate NRA	Sediment, Nutrients, Mercury
Pacific Ocean at Baker Beach	Golden Gate NRA	Indicator Bacteria
Pacific Ocean at Muir Beach	Golden Gate NRA	Indicator Bacteria

Source: San Francisco Water Quality Control Board 2009 adapted from 2006 Clean Water Act Section 303d List.

* Note: Richardson Bay is not within Golden Gate NRA, although it does receive a relatively small volume of surface water run-off from the park.

San Francisco and San Mateo Counties. Water quality monitoring has been conducted periodically at the Presidio for several years. Until very recently, however, no monitoring of surface water had been conducted by the National Park Service in the southern Golden Gate National Recreation Area lands.

At Lobos Creek in the Presidio, the Urban Watershed Project, a nonprofit group, has conducted fecal coliform monitoring through a contract with the Presidio. The City and County of San Francisco also recently conducted monitoring in Lobos Creek. Limited

sampling of Lobos Creek was also conducted through the Environmental Remediation Program. Likewise, basic water quality parameters have been collected in Tennessee Hollow by the Urban Watershed Project, and by the National Park Service at the Crissy Field marsh. Some limited water quality monitoring has been conducted within the West Union / San Francisquito Creek watershed (West Union Creek is located within this watershed), but no monitoring has been conducted on NPS lands. The San Francisquito Creek Watershed Council is actively involved in management and monitoring of this watershed. Through the watershed council, consultants have monitored the Bear Creek watershed (including West Union Creek). However, no sites have been located within Phleger Estate or the adjacent county park (NPS 2005a). San Francisquito Creek is listed on the Section 303d list as being impaired by sediment. Concerns in West Union Creek, a San Francisquito Creek tributary within Phleger Estate, include erosion and runoff from trails. Landslides and significant bank erosion have been observed (NPS 2005a).

Issues in Milagra, Sanchez, and Calera creeks are mostly unknown due to the lack of water quality data. However, suspected issues in these urban creeks include fertilizer or pesticide runoff from lawns and a golf course. In addition, pet waste, oil and chemical runoff from roads, and bacteria and nutrient inputs from leaky sewer pipes are also suspected concerns (NPS 2005a).

Marine Resources

Marine Environment – Regional Overview

The Golden Gate National Recreation Area coastal waters include coastal and marine habitats of central and northern California, which overlap with portions of the Gulf of the Farallones National Marine Sanctuary and Monterey Bay National Marine Sanctuary. The area shares many other features with the sanctuaries due to its proximity and the influence of similar currents, seasonal upwelling, and weather patterns. Geological features include a broad continental shelf; rocky shores; sandy beaches; coastal estuaries such as San Francisco Bay, Elkhorn Slough, and Tomales Bay; offshore banks; and the sloping edges of the continental shelf, dissected by deepwater canyons such as the Monterey Submarine Canyon (NMS and NOAA 2006).

This unique combination of oceanographic conditions and undersea topography make the area rich and diverse in a variety of marine species, including a wide array of temperate cold-water species and occasional influxes of warm-water species. The species diversity is directly related to the diversity of habitats and oceanic conditions, which are described in the following section, and the location of the sanctuaries within a broad transition zone providing a complex gradient of changing environments in which the relative proportions of species changes from north to south (NMS and NOAA 2006).

The species north of Point Conception, an area encompassing the entire study region and extending right up through Washington State, are part of the Oregonian biogeographic province. The relative amount and location of upwelling and downwelling and, consequently, the amount of productivity seen along the coast, are affected by seasonal weather patterns and the influence of the California and Davidson currents. The distribution of each species in the ocean is determined by a multitude of factors, including temperature, salinity, oxygen content, nutrient availability, current speed and direction, species interaction, frequency of perturbation, and food availability (NMS and NOAA 2006).

Habitats

The nearshore marine environment includes bay and estuarine habitats created by mudflats, tidal wetlands, and rocky shorelines; it extends through the intertidal to the subtidal zone of the continental shelf. This shelf extends far from the coast; because upwelling occurs near shore, the coastal zone offers a relatively shallow, highly productive habitat for fish, invertebrates, marine mammals, and seabirds. Many portions of the park's subtidal zone overlap with the federally protected Gulf of the Farallones National Marine Sanctuary to the north and the Monterey Bay National Marine Sanctuary to the south. The area is considered a biological hot spot; data that is available for some species (seals, invertebrates (abalone), fish (rockfish), and shorebirds) indicate that most populations are slowly recovering from historic declines. Rocky and sandy substrates predominate with kelp communities occurring in scattered areas predominantly along the Point Reyes National Seashore and Golden Gate National Recreation Area coastlines north of San Francisco Bay. Research on physical processes is underway with promising new approaches for coastal benthic mapping, such as multibeam sonar, helping to elucidate nearshore habitat complexity. This knowledge is important for resource assessments as an aid to locate and predict species distributions (NPS 2007a).

Along the open coast, intertidal habitats are likely the most heavily impacted aquatic areas. Despite park protection, these habitats are impacted by recreational activities including boating, fishing, and hiking; park operations (beach cleaning); and nonpark facilities and activities (sand movement by City of San Francisco). Significant impacts also occur from previously constructed facilities and loss of marine/estuarine habitats from filling (e.g., historic Crissy marsh filled, riprap and seawalls along San Francisco shoreline, and Fort Baker marsh). The principal water quality threats include bacterial and nutrient pollution (ranches, dairies, septic and stormwater discharges), occasional oil spills from offshore tankers, and legacy military landfills. Though beach sampling and damage incident reports have identified many of these problems, the extent of these impacts on intertidal organisms is not well studied (NPS 2007a).

Estuarine Resources. Approximately 59 miles of ocean and bay coastline are included in Golden Gate National Recreation Area (NPS 2007a). Coastal and bay resources comprise biologically diverse and complex ecosystems that contain a rich array of marine invertebrates and algae. Intertidal communities within or adjacent to the boundaries include islands, islets, reefs, rocks, straits, lagoons, mudflats, beaches, piers, wharves, the Gulf of the Farallones, and the San Francisco Bay Estuary (NPS 1999b).

Golden Gate National Recreation Area estuaries, bays, and lagoons have endured considerable physical disturbance and pollution due to their proximity to the highly urbanized City of San Francisco. Some areas were heavily modified in past eras, causing major changes in habitat structure, including Big Lagoon at Redwood Creek, Horseshoe Bay, and Crissy Field. Restoration is either planned or already accomplished in these areas. In the recent past, the San Francisco Peninsula experienced significant bacterial pollution from stormwater runoff; however, treatment since the 1990s has significantly reduced pollution levels. High levels of PCBs, PAHs and heavy metals are still major issues facing San Francisco Bay coastal waters, and continued restoration is likely to improve local water quality conditions in some areas like the nearshore Presidio (NPS 2007a).

While active restoration efforts are reclaiming wetlands, some bays are accumulating too much sediment. Though sedimentation is a natural process, Tomales Bay, Drakes Bay, and Bolinas Lagoon appear to be experiencing higher than normal sedimentation rates. The evaluation of these complex tidal system dynamics and the possible impacts due to climate change will depend on accurate habitat mapping procedures. Currently, there is significant emphasis in Point Reyes National Seashore and Golden Gate National Recreation Area on mapping wetland extent and quality; however, these efforts are not yet completed and historical information on wetland habitats is limited. Where efforts are being made to restore tidal marsh habitat, such as at Redwood Creek and the Giacomini Ranch, understanding of these systems is improving (NPS 2007a).

Intertidal Zone. Intertidal habitat, by definition, is found between the lowest and highest tidal level. This transitional area between sea and land is the strip of shore between the uppermost surfaces exposed to wave action during high tides and the lowermost areas exposed to air during low tides. Intertidal habitats vary in type of material and the degree of exposure to surf. Bottom habitat types include those of fine mud, sand, gravel, shale, cobble, boulders, and bedrock. Intertidal habitat within Golden Gate National Recreation Area includes rocky and sandy beaches (NMS and NOAA 2006).

The south side of Alcatraz Island contains a sheer rock wall that terminates on a narrow rock reef about 30 to 50 feet wide. This narrow intertidal reef extends for only a short distance (about 660 feet) but represents one of the few rocky reefs within the San Francisco Bay. Other rocky intertidal portions of the island are comprised of riprap and rubble similar to the shorelines of much of the San Francisco Bay.

Subtidal and Nearshore Waters. Subtidal and nearshore waters refer to the area from the lowest low tide line to the point where the seafloor drops and the deeper offshore waters begin. This is on the land side of the continental shelf slope transition. The substrate can be sand, mud, or rock, providing essential habitat for various algae, zooplankton, and phytoplankton species (NMS and NOAA 2006). The nearshore coastal environment is highly variable along the park's shorelines, with a complex spatial distribution of marine resources due to diverse lithologies, active tectonic and geomorphic processes, topographic relief, and dynamic nearshore currents. This physical diversity coupled with high productivity results in an equally diverse distribution of organisms (NPS 2007a).

Because the continental shelf extends far from the coast and upwelling occurs nearshore, the coastal portion of the park offers a shallow, highly productive habitat for sea birds, fish, and marine mammals. Currents, bathymetry (depth), and substrate determine the distribution of marine communities in the subtidal zone. These factors in turn affect more inland habitats, such as the intertidal zone, bays, and estuaries, to varying degrees. Though much of this discussion focuses on coastal subtidal areas, it should be noted that estuarine areas also include subtidal areas. Subtidal habitats are particularly threatened in San Francisco Bay and the surrounding coastline due to intense coastal development and expansion of marine transportation systems. Dredging for port modernization, sand mining, and alteration of rocky reef habitats near navigation channels can severely impact subtidal habitats (NPS 2007a).

Continental Shelf and Slope. The continental slope, which is still considered part of the continent, together with the continental shelf, is called the continental margin. Large areas of the Golden Gate National Recreation Area waters (and state lands lease waters)

overlap with Gulf of the Farallones National Marine Sanctuary and Monterey Bay National Marine Sactuary; these waters cover both the continental shelf and slope. The overlap occurs in Tomales Bay, and from Stinson Beach to Point Bonita. From the shoreline to a depth of about 328 to 492 feet, the shelf is nearly horizontal, with rocky outcrops, gravel, sand, clay, silt, and deposits of broken shells covering it. About 25 miles from the coast, the seafloor drops off, creating the continental slope with a grade of about 3 degrees. The slope extends to about 2 miles deep and is covered with uniform sandy sediment (NMS and NOAA 2006).

BIOLOGICAL RESOURCES

Habitat (Vegetation and Wildlife)

Marine and Estuarine

Intertidal Zone

The intertidal habitat (the area between high tide and low tide lines) is biologically rich, supporting diverse assemblages of organisms. It is characterized by extreme conditions caused by wind, waves, and the fluctuation of tides. The animals inhabiting intertidal zones are subject to periodic immersion in water, followed by exposure to air. They must withstand varying degrees of wave shock, dramatic temperature changes, changes in moisture, attacks from both marine and terrestrial predators, and human-caused effects, such as trampling and collecting (NMS and NOAA 2006).

Four zones of rocky intertidal organisms are traditionally associated with different tidal heights: splash, high intertidal, mid-intertidal, and low intertidal. Species distributions are restricted according to physiological tolerance along the thermal and moisture gradient in the intertidal zone. The splash zone is almost always exposed to air, and has relatively few species. The high intertidal zone is exposed to air for long periods twice a day. The mid-intertidal zone is exposed to air briefly once or twice a day, and the low intertidal zone is exposed only during the lowest tides (NMS and NOAA 2006).

On unconsolidated muddy or sandy shores, algae are rare; benthic diatoms are the only marine algae that may be present. On sandy beaches, much of the invertebrate life—such as worms, crustaceans, snails, and clams—dwell under unconsolidated substrate. Common crustaceans and mollusks include the beach hopper (*Megalorchestia californiana*), spiny mole crab (*Blepharipoda occidentalis*), and sand crab (*Emerita analoga*). Common marine worms include *Anatides groenlandica*, *Eteone dilate*, and *Euzonus* spp. (NMS and NOAA 2006).

Rocky shores support a richer assortment of plants and animals. Algae include numerous species of green, brown, and red algae, as well as beds of surfgrass. A wide variety of invertebrates, including anemones, barnacles, limpets, and mussels, compete for space with the algae in the intertidal zone. Mobile invertebrates, such as sea stars, snails, and crabs, often hide in crevices or under rocks, emerging to graze on algae or prey on other animals. Small fishes may also live in the small pools of water that fill up with each tidal cycle. Typical intertidal invertebrate species of central and northern California include lined shore crab (*Pachygrapsus crassipes*), purple shore crab (*Hemigrapsus nudus*), isopods (*Idotea* spp.), California mussels (*Mytilus californianus*), periwinkles (*Littorina*

spp.), lemon nudibranch (*Anisodoris nobilis*), troglodyte chiton (*Nuttallina californica*), bat star (*Patiria miniata*), black turban snail (*Chlorostoma funebris*), the giant green anemone (*Anthopleura xanthogrammica*), aggregating anemone (*Anthopleura elegantissima*), and other species of bryozoans, nudibranchs, sponges, and tunicates. Intertidal fishes, such as the crevice kelpfish (*Gibbonsia montereyensis*) and the tide pool sculpin (*Oligocottus maculosus*), are limited to tide pools or to passing through the intertidal zone at high tide (NMS and NOAA 2006).

Birds forage in the intertidal zone at low tide or roost in the cliffs just above the shore. There are a great many species of shorebirds along the beaches, including sanderlings (*Calidris alba*), short-billed dowitchers (*Limnodromus griseus*), western gulls (*Larus occidentalis*), glaucous-winged gulls (*Larus glaucescens*), and California gulls (*Larus californicus*). Shorebirds, such as sanderlings and dowitchers, routinely forage in the receding surf, an indication that there are sand-dwelling crustaceans available. Another bird found in this area is the snowy plover (*Charadrius alexandrinus nivosus*), whose threatened status has resulted in some significant resource management actions in central California, including restrictions on access or types of use in some shoreline areas. In addition to the snowy plover, typical shorebird breeders in this habitat include the black oystercatcher (*Haematopus bachmani*), killdeer (*Charadrius vociferus*), sanderlings, willets (*Catoptrophorus semipalmatus*), and marbled godwits (*Limosa fedoa*). Brown pelicans (*Pelecanus occidentalis*), surf scoters (*Melanitta perspicillata*), grebes (family *Podicipedidae*), cormorants (*Phalacrocorax* spp.), and many other seabird species can be found in water beyond the breaking waves or flying through the area. Caspian terns (*Sterna caspia*), Forster terns (*Sterna forsteri*), and whimbrels (*Numenius phaeopus*) are some of the summer migrants that forage along the coastal beaches. Winter migrants include loons (*Gavia* spp.), willets, black-bellied plovers (*Pluvialis squatarola*), godwits (*Limosa* spp.), and turnstones (*Arenaria melanocephala*) (NMS and NOAA 2006).

Marine mammals are also found in this habitat. Pacific harbor seals (*Phoca vitulina*), and California sea lions (*Zalophus californianus*) are frequently seen seaward of the surf zone; sea otters (*Enhydra lutris*) and Steller sea lions (*Eumetopias jubatus*) are occasional visitors. Seals and sea lions haul out on intertidal shores for warming and breeding (NMS and NOAA 2006).

At Alcatraz Island, the rocky intertidal community on the Alcatraz reef is characterized by attached flora and fauna such as rockweed (*Fucus gairdneri*), turfweed (*Endocladia muricata*), and barnacles. Areas with crevices and overhangs often harbor mobile species such as shore crabs and seastars.

Subtidal and Nearshore Waters

Subtidal habitats (depths below mean low water) and nearshore waters (shallow inshore waters of the continental shelf) support many different species. Krill (*euphausiids*) is a crucial or “keystone” species in the area. They are small, shrimp-like crustaceans that congregate in large dense masses called swarms or clouds. Two krill species form the primary forage for upper trophic levels in the adjacent sanctuary. Krill feed on phytoplankton and are very important in the food web because many other species feed on krill. Krill form a key trophic link in coastal upwelling systems between primary production and higher trophic level consumers. Most marine predators subsist at least part of the year on krill, which is the primary prey of seven of the ten most important

commercial fishes on the central California coast. Krill are also very important food sources for baleen whales and seabirds (NMS and NOAA 2006).

The nutrient-rich sanctuary waters near Golden Gate National Recreation Area provide forage for the largest concentration of breeding seabirds in the continental United States. More than 120 species of birds use these three sanctuaries for shelter, food, or as a migration corridor. Of these, over 40 species are known to use the sanctuary during their breeding season (NMS and NOAA 2006).

These same productive waters also support a variety of marine mammals, including gray whales (*Eschrichtius robustus*), humpback whales (*Megaptera novaeangliae*), blue whales (*Balaenoptera musculus*), Dall's porpoise (*Phocoenoides dalli*), harbor porpoise (*Phocoena sinus*), Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), northern right whale dolphins (*Lissodelphis borealis*), Risso's dolphins (*Grampus griseus*) and killer whales (*Orcinus orca*). Some species, such as the gray whale, are only seasonal migrants; others, such as the blue, humpback, and killer whale, travel to the area to feed. Other marine mammals, such as harbor seals and sea lions, can be found in these areas year round (NMS and NOAA 2006).

Six species of pinnipeds, some of which are federal listed, are found in the waters offshore of the park. Pinnipeds spend a large amount of time in offshore waters or on offshore islands, but some of the rookeries (breeding places or breeding colonies usually crowded with the same species) and haul-out areas occur in this habitat. Species found in the area are California sea lion, Pacific harbor seal, Steller sea lion, northern elephant seal (*Mirounga angustirostris*), northern fur seal (*Callorhinus ursinus*), and on occasion, the Guadalupe fur seal (*Arctocephalus townsendi*). The various species have numerous seal rookeries or colonies and are found at different times of the year, feeding on the abundant fish and invertebrate resources of the island shelves or hauling out on rocks and beaches (NMS and NOAA 2006).

A variety of fish species occur within these habitats, including rockfishes, cabezon, surfperch (family *Embiotocidae*), wrasses (family *Labridae*), and señorita, (*Oxyjulus californica*). Commercially harvested species include salmon, tuna, crab, squid, and various rockfish. Salmon and crab fisheries are the most important fisheries in the sanctuaries. The West Coast Dungeness crab fishery is considered the most sustainable large-scale commercial crab fishery in the world. Both chinook and coho salmon are coastal migrants. (NMS and NOAA 2006).

Kelp forests support a variety of species, including sea otters and sea urchins. Other marine mammals, such as harbor seals and California sea lions, are common in and around kelp forests, as are a variety of fishes, such as the señorita, the kelp surfperch (*Brachyistius frenatus*), blue rockfish (*Sebastes mystinus*), blacksmith (*Chromis punctipinnis*), and olive rockfish (*S. serranoides*). The kelp canopy, stipes, and holdfasts increase the available habitat for nearshore species and offer protection to juvenile finfish. Bat star (*Asterina miniata*), sea lemon (*Anisidoris nobilis*), barnacles (*Balanus spp.*), red volcano sponge (*Acanthus erithacus*), and urchin are a few of the many types of invertebrates that inhabit the kelp forest and rocky subtidal habitats (NMS and NOAA 2006).

Golden Gate National Recreation Area contains areas of sandy beaches, some barely accessible narrow strips along the shoreline while others are large expanses readily

accessed and heavily used by visitors. Beach wrack—a thick tangle of kelp and sea grass that washes ashore during high tides—supports an intricate food web and community. Until recently, beach wrack was removed from many park beaches; now this practice has been discontinued. Recreational activities on park beaches, unleashed dogs, and kayaks impact both shorebird and pinniped populations. Efforts to minimize disturbance during the past 5 to 10 years appear to have met with some success and certain species such as snowy plover and harbor seal populations seem stable after years of decline (NPS 2007a).

Although local data are not comprehensive, notable trends and observations for key indicators in California nearshore marine and estuarine habitats likely to occur in the parks include the following:

- a decline in populations of all California abalone
- northward spread of the rickettsial-like bacteria responsible for withering syndrome in black abalone which was recently observed just south of Golden Gate National Recreation Area
- a decline in rockfish species such as bocaccio (*Sebastes paucispinus*)
- a decline in the extent of kelp forests caused by pollution, wave damage due to storms, and El Niño warming
- stable Dungeness crab populations as a result of successful fisheries management
- an increase in dune- and beach-dependent snowy plovers after significant declines observed in the mid 1990s resulted in protective management
- stable population levels of harbor and elephant seals
- a decline in pelagic sea birds due to climate regime shifts and human disturbance including bycatch, nest disturbance, and oil spills
- an increase in tidal marsh lands due to restoration activities and protective measures (NPS 2007a)

Estuarine and Lagoon

Estuaries and lagoons serve as important habitats for many fishes, birds, and mammals. They provide suitable habitat for reproduction, feeding, resting, and cover. Estuaries and lagoons support unique biological communities with both aquatic and terrestrial characteristics. Halophytic vegetation, such as pickleweed (*Allenrolfea occidentalis*), grows higher in the marsh where flooding occurs less frequently and salt may become concentrated. However, little vegetation can grow in areas characterized by high evaporation and high soil salinity. A diverse assemblage of wetland plants grows in areas near tidal creeks where fresh water input is high. As the plant matter breaks down into detritus, it is consumed by various filter feeders, deposit feeders, and other omnivores and scavengers. These species, in turn, provide abundant food resources for other species of fish, birds, and mammals. Brackish water supports a distinctive assemblage of invertebrate and fish species, including the endangered tidewater goby (*Eucyclogobius newberryi*). Other estuarine species can include jacksmelt (*Atherinopsis californiensis*), Pacific sardine (*Sardinops sagax caerulea*), Pacific herring (*Clupea pallasii*), staghorn sculpins (*Leptocottus armatus*), several rockfishes, salmonids, and clupeids (*Clupeonella* spp.) (NMS and NOAA 2006).

The estuaries and bays of coastal California are part of the Pacific Flyway, one of the four principal bird migration routes in North America. San Francisco Bay supports a large number of migratory and resident birds. Also important for birds are Tomales Bay, Bolinas Lagoon, Pescadero Marsh, and Elkhorn Slough. Bolinas Lagoon and Tomales Bay are designated wetlands of significant international importance under the Convention on Wetlands. Marine mammals, including harbor seal, harbor porpoise, and sea otter, occur in these bays (NMS and NOAA 2006).

Seagrass beds, which occur in the bays and lagoons, are highly productive habitats that support a unique assemblage of invertebrates and fishes. Many fishes, including Pacific herring, spawn in seagrass beds among other habitats. The structure of seagrass beds provides protection from predation for juvenile invertebrates and fishes. Large numbers of shorebirds and waterfowl are attracted to seagrass beds, where they feed on the seagrass, fishes, and invertebrate eggs and young (NMS and NOAA 2006).

The marine environment around Slide Ranch includes exposed outer coastlands with a rich display of sponges, hydroids, bryozoans, and tunicates. Muir Beach is also home to a variety of submarine sponges, hydroids, bryozoans, and tunicates. Tennessee Cove contains unique geological features including the only California central coast display of highly polished and fossilized shells of *Collisella digitalis*. Sea caves contain unusually large isopod (*Ligia occidentalis*) specimens. Kirby Cove contains giant isopods of unusually large size and high densities of starfish (*Pisaster ochraceous* and *Patiria miniata*). Bird Island, with its guano-covered sea stack, produces abnormally sized marine invertebrates and plants, including large California mussels and surfgrass, marine kelp and giant kelp, sea anemones and purple seastar, as well as high densities of marine copepod (*Tigriopus californica*). The underwater marine life is abundant and includes high densities of sponges, hydroids, bryozoans, and tunicates. The Alcatraz intertidal zone ranks high in its abundance and diversity of marine algae (NPS 1999b).

Estuaries, bays, and lagoons provide rich habitats including subtidal seagrasses, tidal mudflats, and marshes that support a rich diversity of wildlife. Past shoreline modifications, including wetland fill and seawalls, dramatically reduced the extent of tidal marsh within the park. Inherently lower rates of hydrologic mixing in estuaries and especially in lagoons, enhances their vulnerability to pollution and invasive species (NPS 2007a).

Although at much lower levels and not as well studied as in San Francisco Bay, invasive species are established in estuaries and lagoons in northern coastal areas of the park. Despite these threats, Tomales Bay and Drakes Estero are considered relatively pristine and support variable but healthy biological communities. Wetland restoration projects, such as the Muir Beach / Big Lagoon restoration project will further enhance resource condition (NPS 2007a).

Due to its favorable currents and nearshore foraging areas, the waters around Alcatraz Island provide rich sources of food for the colonial waterbirds that nest on the island (NPS 2001). These waters are subject to the same influences as the rest of San Francisco Bay.

Benthic Communities

The benthic community is made up of organisms that live in and on the bottom of the ocean floor. Benthic species include worms, clams, crabs, lobsters, sponges, and other

tiny organisms that live in the bottom sediments. Benthic species are divided into the filter feeders and the deposit feeders. Filter feeders filter their food by siphoning particles out of the water.

Various benthic habitats and substrates are found within the waters off Golden Gate National Recreation Area. In addition, benthic communities occur in a variety of the habitats described in this section, including subtidal rocky reefs, kelp forests, soft bottom habitats, and deep ocean floor habitats. The continental shelf descends gradually from the coast to the shelf break. Benthic communities along the continental shelf are covered in part by a layer of mud. Outcropping bedrock and sand cover the continental shelf at depths greater than 295 feet. Benthic organisms play a critical role and make up a diverse group that is a major link in the food chain (NMS and NOAA 2006).

Terrestrial/Freshwater

Plant Communities

The vegetation of Golden Gate National Recreation Area is a result of the juxtaposition of physical landforms and water masses, and associated geology, climate, and history. The moist maritime climate along the coastline is a dominant influence, while the park's east-facing sites are subject to drier inland conditions. Distinct changes in soils from the rich conditions of the Franciscan melange to the unique chemistry of serpentinitic outcrops have created a diverse mosaic of vegetation communities. Natural processes, including landslides, rainfall patterns, and fires, affect these patterns and add another layer of complexity to the system. Golden Gate National Recreation Area is known to support 572 native species, including 336 nonnative terrestrial plant species (NPS 2005a).

Alcatraz Island generally consists of grasses, shrubs, historic gardens, nonnative trees, and cliffs and other barren areas, along with buildings and other paved areas. The landscape vegetation consists of a diverse group of nonnative ornamental shrubs and trees, which provide the vegetative structure and habitat for wildlife on the island (NPS 2001).

Coastal Scrub and Chaparral. The coastal scrub community is dominated by coyote brush (*Baccharis pilularis*), California sagebrush (*Artemisia californica*), bush lupine (*Lupinus arboreus*), and poison oak (*Toxicodendron diversilobum*), with variations in dominant species based on moisture levels, soil types and slopes, and past land use history. This community intergrades and creates a mosaic with the grassland community, and is found throughout the park from near sea level to 2,500 feet in elevation. The coastal scrub community includes a wide variety of native perennial forbs (*Lupinus albifrons* and others) and large numbers of nonnative species; at times it is dominated by nonnative shrubs such as French broom (*Genista monspessulana*) and thoroughwort (*Ageratina adenophora*). Chaparral stands exist within the park, but are not all that abundant. Small communities of chaparral exist in Muir Woods National Monument and the Marin Headlands, as well as larger areas on Bolinas Ridge. There are several types of chaparral in the park, including chamise chaparral, ceanothus chaparral, and manzanita chaparral (NPS 2005a).

Grasslands. The grassland community at Golden Gate National Recreation Area extends from sea level to nearly 2,600 feet in elevation. It forms a mosaic with the coastal scrub community and mixed evergreen forests. The coastal prairie areas appear to have evolved

under light seasonal grazing pressure from native tule elk and other herbivores with occasional fire (NPS 2005a).

Pristine grassland was thought to have been composed of evenly spaced bunchgrasses with annual forbs occupying areas between tussocks. It has been shown that purple needlegrass (*Nasella pulchra*)—the California state grass—was a major dominant of that grassland type along with other perennial grasses. These grasslands have had the greatest disturbance of any natural habitat in this area. Four main factors have contributed to this disturbance: 1) an increase in grazing pressures from nonnative cattle, sheep, and horses, 2) the introduction of highly competitive nonnative plants, 3) cultivation, and 4) the elimination of fire (NPS 2005a). Today, the grasslands are dominated by nonnative annual grasses and forbs adapted to Mediterranean conditions. (NPS 2005a).

The extirpation of large native mammals, exclusion of grazing by native herbivores, and suppression of wildfires have caused a marked increase in acreage covered by coyote brush and the resulting coastal scrub community in the Bay Area. It should be noted that grassland and coastal scrub communities are a dynamic mosaic with changes in dominance over time, and in some areas these two communities are in equilibrium with no invasion occurring (NPS 2005a).

Riparian Forest and Scrub. These streamside forests and shrub lands are dominated by broad-leaved deciduous trees or shrubs, most commonly willows (*Salix lasiolepis* or *S. lucida* ssp. *lasiandra*) and occasionally red alder (*Alnus rubra*). The understory is typically dense, with a variety of shrubs including native berries—native salmonberry (*Rubus spectabilis*), thimbleberry (*R. parviflorus*), and California blackberry (*R. ursinus*)—as well as nonnative Himalayan blackberry and cape ivy. Numerous herbaceous species, including ferns, rushes, and sedges, dominate the shrub understory. Nonnative trees, including eucalypts (*Eucalyptus* spp.) and Monterey cypress (*Cupressus macrocarpa*), have become successfully established within the riparian forest strands in the park (NPS 2005a).

Douglas-fir and Coast Redwood. The majestic old-growth redwood forest at Muir Woods National Monument, with Redwood Creek peacefully flowing through groves of tall trees, attracts much visitor attention. This tranquil scene is a rare sight close to a large metropolitan area. Many species contribute to this ecosystem. Major overstory and understory trees include coast redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*), California bay laurel (*Umbellularia californica*), tanoak (*Lithocarpus densiflorus*), California hazel (*Corylus californica*), and madrone (*Arbutus menziesii*) (NPS 2005a). Douglas-fir communities are found on Bolinas Ridge and within Muir Woods National Monument. The communities on Bolinas Ridge have been previously logged.

Nonnative Evergreen Forest. Many nonnative tree species have become established in Golden Gate National Recreation Area through both intentional and unintentional introductions, including ornamental plantings, plantings for windbreaks or shade for pastures, and escapes from cultivated and developed areas. Many of these trees—including a number of eucalypts (*Eucalyptus* spp.), acacia (*Acacia* spp.), Monterey pine (*Pinus radiata*), and Monterey cypress (*Cupressus macrocarpa*)—have invaded native communities. Most are very flammable, or significantly change the fire potential in areas that otherwise would support low-intensity or minimal fires, such as the coastal scrub and grassland areas of the park (NPS 2005a).

Plant Communities of Alcatraz Island. Before occupation by Europeans, Alcatraz Island was sparsely vegetated. Trees and shrubs were planted as part of military fort and penitentiary life on the island. Soils brought from the mainland and surrounding islands in the bay contained seeds of native plants, including coyote brush, California poppy (*Eschscholzia californica*), and California blackberry (*Rubus ursinus*), which have become established on the island. Only about 5% of the island has native grasses or coastal scrub species; the rest is dominated by nonnative species (NPS 2001).

The landscape vegetation is nonnative, but it provides significant shelter and habitat on the island. Shrubs are common and include nonnative rose, mirrorbush, fig, blackberry, agave, Australian tea ivy, mimosa, plume acacia, Monterey cypress, and native coyote brush. A small stand of native grasses dominated by creeping wildrye (*Leymus triticoides*) is located on the Northeast Perimeter Trail near the Power House complex. Another smaller stand is present in the Cistern area. Ruderal vegetation occurs along the edges of walkways, buildings, and building remains. Dominant species in these areas are wild oats, wild radish, mustard, and cheeseweed. Rocky cliffs and bluffs are found primarily along the island perimeter. The southwestern cliffs support various succulents, agave, sourgrass, sweet alyssum, wild radish, and large shrubs in areas where Brandt's cormorants, western gulls, and pigeon guillemots nest. These plants provide nesting material and protection for the birds (NPS 2001).

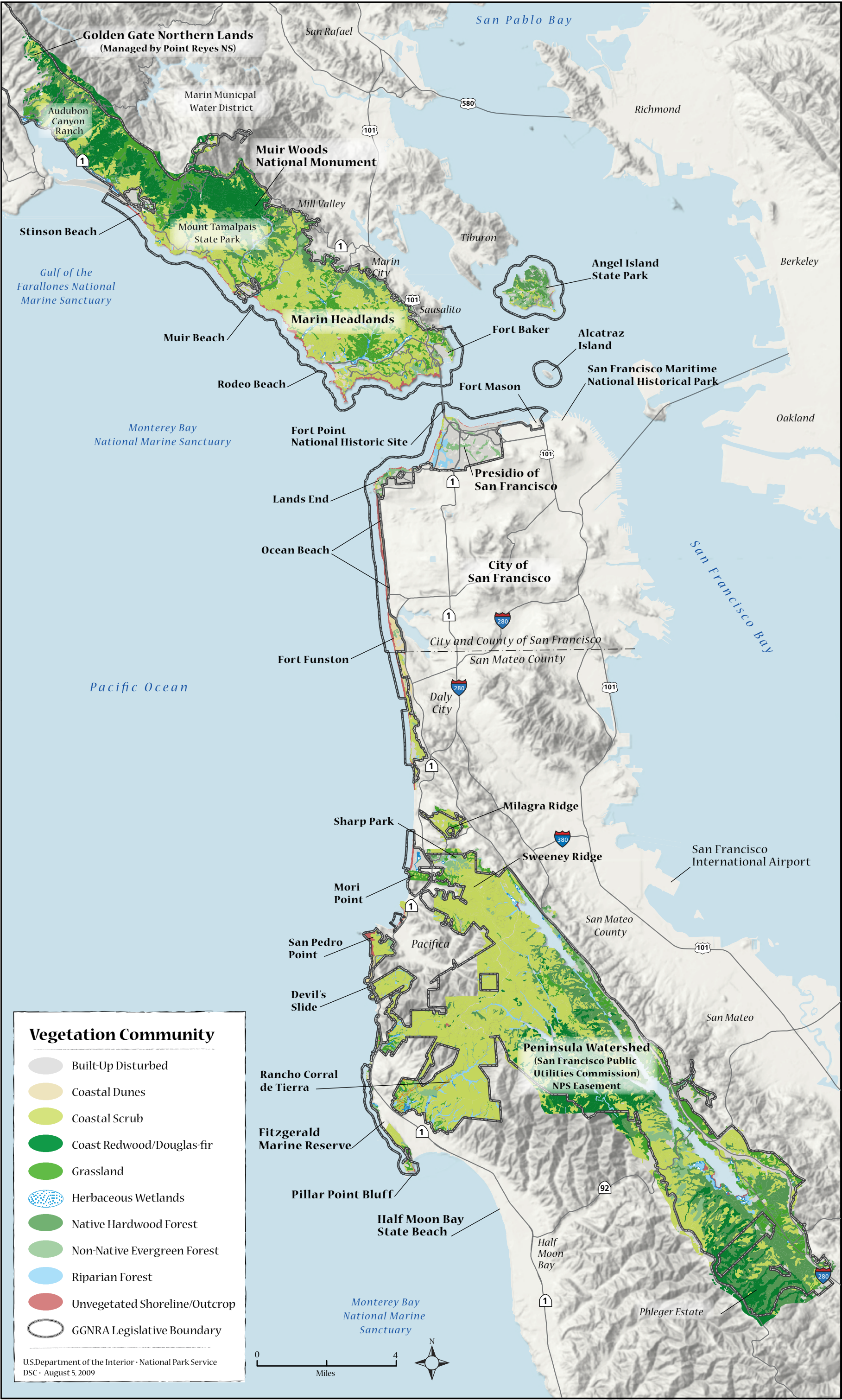
Wetlands. Herbaceous wetlands are known as emergent wetlands in the Cowardin wetlands classification. They consist of a mix of low-growing species of native sedges (*Carex* spp.), rushes (*Juncus* spp.), and other wetland-dependent species (*Scirpus microcarpus*, *Typha* spp. *Cyperus eragrostis*, *Equisetum* spp.), as well as some nonnative species of grasses and forbs. The nonnative grasses include velvet grass (*Holcus lanatus*) and harding grass (*phalaris aquatica*) and the forbs include cape ivy (*Delairea odorata*) and vinca (*Vinca major* and *V. minor*). Also included are areas covered with various reeds along the shores of lagoons and ponds, herbaceous strips of vegetation along perennial and ephemeral stream courses, and isolated wetland patches where seeps spring from the hill slopes. Some special status plant species—locally to regionally rare—occur within this community (NPS 2005a).

Golden Gate National Recreation Area has abundant wetland resources, including wet meadows, seeps, streams, riparian forests, lakes, ponds, and lagoons. Wetlands, according to the definition developed by the U.S. Fish and Wildlife Service and adopted by the National Park Service, are lands transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands generally include marshes, riparian zones, mudflats, rocky intertidal zones, and gravel beaches. Deepwater habitats such as rivers, lakes, and estuaries are not technically wetlands but are classified as aquatic sites using the same classification system. Wetland ecosystems act to buffer hydrologic and erosional cycles, control and regulate cycles of nitrogen and other key nutrients, and create valuable habitat for animal species.

The wetlands in Golden Gate National Recreation Area have been field-mapped in several watersheds, including the Rodeo Creek watershed, the Presidio of San Francisco, and portions of the Redwood Creek and Bolinas Lagoon watersheds. The remainder of the park has not been field-mapped, but likely contains areas of wetland vegetation based on parkwide vegetation mapping results that need field verification. The majority of

PART 7: THE AFFECTED ENVIRONMENT

wetlands in Golden Gate National Recreation Area are located in the valley bottoms, with seeps and small intermittent streams reaching into the higher portions of the watersheds (NPS 2005a).



Wildlife

The entire park is included within the Central California Coast International Biosphere Region. The park's diverse habitats support a rich assemblage of wildlife. At least 387 vertebrate species are known to occur within the park boundaries. Species lists compiled from a variety of sources and incomplete inventories include 11 amphibians, 20 reptiles, 53 fish, 53 mammals, and 250 birds. Terrestrial invertebrates in the park are less well known; however, two areas of the park, Marin Headlands and Milagra Ridge, support diverse butterfly populations. Wildlife habitats within the park include introduced eucalyptus and closed-cone Monterey pine and cypress forests; hardwood, mixed evergreen, Douglas-fir, redwood, and riparian forests; coastal scrub; annual and perennial grasslands; freshwater and saline wetlands and wet meadows; and estuarine, lacustrine, marine, and riverine aquatic habitats (NPS 2005a).

Alcatraz Island is a valuable natural habitat for colonial waterbirds due to favorable currents and nearshore foraging areas. The island supports a diverse assembly of marine and estuarine colonial nesting birds. Species of particular interest are black-crowned night herons, pigeon guillemots, Brandt's and pelagic cormorants, and western gulls (NPS 2001).

Mammals. Terrestrial habitats within the planning area support a diversity of mammals. Meso-carnivores, including the gray fox (*Urocyon cinereoargenteus*), bobcat (*Felis rufus*), and the recently reestablished coyote (*Canis latrans*), inhabit coastal scrub and grasslands. Mountain lions (*Felis concolor*) have been sighted in some undeveloped areas of the park. These carnivores feed on a variety of small and large mammals such as the Pacific black-tailed deer (*Odocoileus hemionus columbianus*), broad-footed mole (*Scapanus larimanius*), pocket gopher (*Thomomys bottae*), deer mouse (*Peromyscus maniculatus*), western harvest mouse (*Reithrodontomys megalotis*), California vole (*Microtus californicus*), and brush rabbit (*Sylvilagus bachmani*). Badgers (*Taxidea taxus*) are also infrequently encountered. Some species, such as the western harvest mouse, appear to be restricted to areas where native perennial grasses persist (NPS 2005a).

In addition to many of the aforementioned mammals, Muir Woods National Monument and other forested areas within the planning area support vagrant shrew (*Sorex vagrans*), Trowbridge's shrew (*Sorex trowbridgii*), Sonoma chipmunk (*Tamias sonomae*), western gray squirrel (*Sciurus griseus*), opossum (*Didelphis virginiana*), and dusky-footed woodrats (*Neotoma fuscipes*). Other mammalian carnivores include the raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and spotted skunk (*Spilogale gracilis*), long-tailed weasel (*Mustela frenata*), and the recently returned river otter (*Lontra Canadensis*) (NPS 2005a).

Seventeen species of bats have been detected within the park. Ten species of bats have been documented in Muir Woods National Monument, including four at-risk species: Townsend's western big-eared bat (*Corynorhinus townsendii townsendii*), fringed myotis (*Myotis thysanodes*), long-legged myotis (*Myotis volans*), and Yuma myotis (*Myotis yumanensis*). Many of the bats have been observed using redwood fire-scar cavities for roosting. At the Marin Headlands, several historic World War II structures were found to be occupied by the Townsend's western big-eared bat and the Yuma myotis. The Brazilian free-tailed bat (*Tadarida brasiliensis*) forages over coastal scrub habitat within the Marin Headlands (NPS 2005a).

Isolated coastal rocks, beaches, and lagoon sand flats in the park serve as haul-outs for harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*). Up to 250 harbor seals haul out in Point Bonita Cove along the slopes of the Marin Headlands. As the northern elephant seal (*Mirounga angustirostris*) population rapidly increases, the seals are encountered more frequently on sandy beaches throughout the region. California gray whales (*Eschrichtius robustus*), humpback whales (*Megaptera novaeangliae*), and harbor porpoises (*Phocoena phocoena*) use offshore waters; young whales occasionally wander into San Francisco Bay. Southern sea otters (*Enhydra lutris nereis*) are infrequently seen offshore with numbers increasing as the population spreads north (NPS 2005a).

Alcatraz Island is home to deer mice and several bat species. Small numbers of seals and sea lions haul out on the island's rocky areas (NPS 2001).

Birds. Located along the Pacific Flyway, Golden Gate National Recreation Area provides habitat for a great diversity of breeding, overwintering, and migratory birds. Nineteen species of diurnal raptors have been detected in migration over the ridges of the Marin Headlands. Red-tailed hawks (*Buteo jamaicensis*), red-shouldered hawks (*Buteo lineatus*), and great horned owls (*Bubo virginianus*) nest in many of the large nonnative eucalyptus trees in the park. A wide range of other raptors and at least ten owl species occur within the planning area. Numerous species of waterbirds also occur within the park in marine and rocky intertidal habitats, cliffs, beaches, and tidal and wetland areas (NPS 2005a).

Point Reyes Bird Observatory (now Point Reyes Bird Observatory Conservation Science) encountered 83 bird species during 1997 breeding landbird censuses in coastal grassland, coastal scrub, riparian, and mixed hardwood habitats. From point count censuses in 1999 and 2000, white-crowned sparrows (*Zonotrichia leucophrys*), red-winged blackbirds (*Agelaius phoeniceus*), savannah sparrows (*Passerculus sandwichensis*), and song sparrows (*Melospiza melodia*) were the most commonly detected species in grasslands. The most abundant species in coastal scrub were white-crowned sparrows, spotted towhees (*Pipilo maculatus*), and wrentits (*Chamaea fasciata*). In forested habitats, bushtits (*Psaltirparus minimus*), chestnut-backed chickadees (*Poecile rufescens*), dark eyed juncos (*Junco hyemalis*), Pacific-slope flycatchers (*Empidonax difficilis*), and winter wrens (*Troglodytes troglodytes*) were commonly detected. Based on songbird nest monitoring in riparian habitats along Redwood and Lagunitas creeks, the song sparrow, Swainson's thrush (*Catharus ustulatus*), warbling vireo (*Vireo gilvus*), and Wilson's warbler (*Wilsonia pusilla*) were the most commonly observed nesters. The brown-headed cowbird (*Molothrus ater*) is a nest parasite that negatively affects the reproductive success of open-cup nesting songbirds and occurs throughout the planning area. Many of the landbirds in the planning area are Neotropical migrants, with others identified as species of management concern and riparian species of conservation priority by California Partners in Flight (NPS 2005a).

Alcatraz Island is a particularly important site for birds. A number of colonial waterbird species inhabit Alcatraz Island. Waterbird species of interest include Brandt's cormorants (*Phalacrocorax penicillatus*), pelagic cormorants (*P. pelagicus*), western gulls (*Larus occidentalis*), pigeon Guillemots (*Cephus columba*), black oystercatchers (*Haematopus bachmani*), black-crowned night herons (*Nycticorax nycticorax*), snowy egrets (*Egretta thula*), great egrets (*Casmerodius albus*), great blue herons (*Ardea herodias*), and

California gulls (*Larus californicus*). The Brandt's cormorant colony on Alcatraz Island is one of the few known estuarine breeding sites for this species. Pigeon Guillemots breed nowhere else in the San Francisco Bay, and the western gull and black-crowned night heron colonies are among the largest in the Bay (Acosta et al. 2008). None of the waterbird species on Alcatraz Island are special status species.

This diversity of species exists in a delicate balance with the considerable human presence both on and around Alcatraz Island. Colonial waterbird populations on the island experience substantial disturbance from a number of different sources. A large number of visitors tour the island annually, and associated historic preservation and safety construction projects, public access to breeding areas, gardening activities that are part of a historic garden restoration program, and special events could disrupt the breeding efforts of Alcatraz Island seabirds. Encroachment near the Alcatraz Island shoreline by large numbers of commercial or recreational boaters (e.g., tour boats, anglers, kayakers), and uncontrolled aircraft overflights (e.g., air tour operators), may have similar effects. In addition, dredging and other projects that disturb and alter the subtidal environment are potentially disruptive to seabird populations, as these activities may remobilize contaminants, increase turbidity, and destroy essential foraging habitat (Acosta et al. 2008).

In 1993, Golden Gate National Recreation Area completed a management plan for Alcatraz Island, which included provisions for maintaining breeding populations of colonial waterbirds. This plan emphasized protection of the island's natural resources, while maintaining opportunities for visitor access, special events, and other island uses. The plan called for natural resource monitoring and the development of protocols to determine baseline information for key wildlife populations (Acosta et al. 2008).

Amphibians and Reptiles. Small populations of the federal listed threatened California red-legged frog (*Rana aurora draytonii*) occur within the planning area.

Within San Mateo County, historic and current records indicate the presence of the federal listed endangered San Francisco garter snake (*Thamnophis sirtalis tetrataenia*). More common terrestrial amphibians in the planning area include ensatina (*Ensatina eschscholtzii*) and California slender salamander (*Batrachoseps attenuatus*). Common species spending a substantial amount of time at streams or ponds for breeding or rearing purposes include California newts (*Taricha torosa*), rough-skinned newts (*Taricha granulosa*), Pacific treefrog (*Hyla regilla*), and California giant salamander (*Dicamptodon ensatus*). Common reptiles include the Western fence lizard (*Sceloporus occidentalis*), northern alligator lizard (*Gerrhonotus coemleus*), Pacific gopher snake (*Pituophis melanoleucus*), and western terrestrial garter snake (*Thamnophis elegans*) (NPS 2005a).

Alcatraz Island has large populations of California slender salamanders, which are small lungless salamanders that do not require water for breeding. The northern end of the island has moist substrate, which supports the salamanders. Neither the eggs nor the salamanders can tolerate salt spray, so they are limited to upland areas of the island (NPS 2001).

Fish. The planning area includes both resident and transitory fish species that occupy marine, estuarine, and freshwater habitats. Common, nearshore resident estuarine and marine fish include Pacific staghorn sculpin, arrow goby (*Clevelandia ios*), and topsmelt

(*Atherinops affinis*). The brackish Rodeo Lagoon in the Marin Headlands supports a large population of the federal listed endangered tidewater goby (*Eucyclogobius newberryi*) (NPS 2005a).

Freshwater streams within the planning area are characterized by naturally low species diversity. Perennial streams may include resident fish such as threespine stickleback (*Gasterosteus aculeatus*) and prickly sculpin (*Cottus asper*). Several important anadromous fish species are present in the creeks and watersheds within the planning area. Anadromous species are those that spawn or breed in streams and rivers and then migrate to and mature in the ocean. Anadromous species that breed and rear in streams within the planning area include endangered coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*). Coho salmon are listed as endangered and steelhead trout are listed as threatened under the Endangered Species Act. Intermittent streams or the intermittent headwater streams may support only steelhead trout (NPS 2005a).

Invertebrates. Two coastal grassland/scrub areas in the park are known for their high numbers and diversity of butterflies: Marin Headlands and Milagra Ridge. The federal listed endangered mission blue butterfly (*Icaricia icarioides missionensis*) occurs at both sites, while the San Bruno elfin butterfly (*Euphydryas editha bayensis*) is found at Milagra Ridge, where it inhabits rocky outcrops. At least 44 species of butterflies occur in the Marin Headlands and 34 species occur at Milagra Ridge, illustrating the importance of habitat fragments within largely developed landscapes. Various species of skippers, swallowtails, hairstreaks, blues, ladies, admirals, and crescents inhabit these areas. Monarch butterflies (*Danaus plexippus*) are found in clusters overwintering in many areas of the park, often in groves of nonnative trees. Other terrestrial invertebrates have not been well documented (NPS 2005a).

Limited information is available regarding the freshwater invertebrates that are present within the planning area. Targeted inventories have been conducted in streams such as Redwood Creek. Two hundred twenty-three freshwater species are known. The only federal listed species is the endangered California freshwater shrimp, which is found within the Lagunitas Creek watershed, an area managed by Point Reyes National Seashore. Limited information is also available regarding invertebrates from marine and estuarine habitats within the planning area. Two hundred seventy-nine marine and estuarine species are known (NPS 2005a).

Alcatraz Island includes a small but significant site used briefly by Monarch butterflies in their fall migration. The butterflies are usually on the island for one to five days during this period and have been reported on vines on the east side of the island and near the chapel (NPS 2001).

Nonnative Wildlife. Many species of nonnative wildlife have been identified as problem species within the park. These species negatively affect populations of native animals through competition for resources, predation, and as vectors for disease. Nonnative terrestrial mammals include fallow deer (*Cervus dama*), feral hogs (*Sus scrofa*), red fox (*Vulpes vulpes*), opossum, house cats (*Felis domestiells*), and Norway and black rats (*Rattus norvegicus* and *R. rattus*). Nonnative birds found in the planning area include wild turkeys (*Meleagris gallopavo*), European starlings (*Sturnus vulgaris*), peewees (*Pavo eristatus*), house sparrows (*Passer domesticus*), and rock doves (*Columba livia*). Nonnative invertebrates present in the planning area include Argentine ant (*Iridomyrmex*

humilis). Nonnative fish present within various human-made ponds include mosquitofish (*Gambusia affinis*) and various sunfish, while estuarine areas may support yellowfin goby (*Acanthogobius flavimanus*). Nonnative amphibian and reptile species include bullfrog (*Rana catesbeiana*), red-eared slider (*Chrysemys picta*), and the occasional caiman (NPS 2005a).

Norway rats have been observed on Alcatraz Island since 1998. The Norway rats are a concern because of their potential as predators of waterbird eggs and chicks on the island. These rats have been known to reduce native rodent populations (NPS 2001).

Special Status Wildlife Species

Habitat for numerous rare or special status wildlife species (i.e., federal and state listed species, species of special concern, and candidate species) exists within the lands and waters of the park's legislative boundary. These special status species are permanent residents of the park, seasonal residents of the park, or rely on the land and waters of the park for migration. Twenty-seven wildlife species that occupy the land and waters of Golden Gate National Recreation Area are listed as threatened or endangered under the Endangered Species Act as amended (16 USC 1536 [a] [2] 1982). Of these, 14 are federal endangered and 14 are federal threatened. It is important to note that three separate populations of the chinook salmon species and two populations of the steelhead trout species exist in the planning area. Since the federal status of the chinook salmon varies across populations (two are threatened, one is endangered), the sum of federal endangered and federal threatened species (28) does not directly coincide with the previously-noted 37 protected species under the Endangered Species Act.

Fourteen of the wildlife species that occupy the lands and waters of the park are also listed as threatened or endangered by the California Endangered Species Act. Of these, 10 species are state endangered, and 4 are state threatened. All but three of these state-listed wildlife species are also federal listed: the exceptions being the bald eagle, bank swallow, and California black rail.

Numerous other wildlife species (birds in particular) are considered sensitive by the Audubon Society, Partners in Flight, or the California Department of Forestry, or are designated Migratory Nongame Birds of Management Concern by the U.S. Fish and Wildlife Service. Nearly all of the native birds documented in the park are protected under the Migratory Bird Treaty Act (16 USC 528-531). Thirty-eight rare or special status plant species are currently identified within the park. Of those species, 9 are federal listed endangered, 1 is federal listed threatened, and 15 are included or proposed for inclusion by the California Native Plant Society (NPS 2005a).

The U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration National Marine Fisheries Service provided a list of federal listed threatened and endangered species for consideration during development of the fire management plan in 2005. This list was used as the initial baseline of information for the development of this general management plan, because the planning areas for the two plans are identical (NPS 2005a). To refine and update the list of special status species in the planning area, the NPS Endangered Species Act Database, the California Department of Fish and Game's California Natural Diversity Database, and park staff data were referenced.

The table in Appendix D identifies the threatened and endangered species that could occur in the planning area. Their current federal and state status and county-specific habitat location are also identified in the table. Appendix D also identifies which of these species have been retained for further analysis of impacts (also see the summary table of impact topics at beginning of part 9 of this document, “The Affected Environment.”).

To evaluate the effects on special status species, a set of species considered likely or possible to experience impacts from GMP actions was selected for assessment based on the presence of suitable habitat within the project area and discussions with NPS biologists.

Marin County

Mission Blue Butterfly – Federal Endangered

Mission blue butterflies (*icarcia icaroides missionensis*) are closely tied to the lupine larval host plants *Lupinus albifrons*, *L. variicolor*, and *L. formosus*, with *L. albifrons* considered to be the preferred host. These host plants tend to occur in grasslands on thin, rocky soils within broader coastal scrub habitats. Lupine are susceptible to fungal outbreaks, which have been documented to cause rapid contractions of lupine distribution at the Marin Headlands. Competition from nonnative plants, including eucalyptus, Monterey pine, grasses, and broom, also threatens lupine host plants. Lupine is a fire-adapted species, and fire may enhance suitable lupine habitat for mission blue butterflies. Adults feed on nectar from numerous plants, though they may prefer wild buckwheat (*Erigonum latifolium*), golden aster (*Chrysopsis vilosa*), blue dicks (*Brodiaea pulchella*), and Ithuriel's spear (*Brodiaea laxa*). Habitat loss is probably the primary threat to mission blue butterflies, with trampling of host and nectar plants, larvae, and pupae also of concern. Other threats to mission blue butterflies at various stages of their life cycles include parasites, predators, and desiccation and disease during diapause (NPS 2005a).

Adults have one generation per year, with a flight period from mid-March to mid-May at the Marin Headlands and late May to mid-June at San Bruno Mountain. Analyses suggest that warmer air temperatures are associated with higher numbers of adults at the seasonal peak and that rainfall is not related to the peak number of adults. Eggs are usually laid on the dorsal surface of larval host plants. Ants (*Prenolepis imparis* and *Formica lasioides*) may tend the later-instar mission blue larvae. Mission blue butterflies occur at the Marin Headlands, Tennessee Valley, Milagra Ridge, and Sweeney Ridge within the planning area (NPS 2005a).

California Red-legged Frog – Federal Threatened

The California red-legged frog (*Rana aurora draytonii*) is found primarily in wetlands and streams in coastal drainages of central California. Red-legged frogs found north of the Marin-Sonoma county border exhibit intergrade characteristics of the California red-legged frog and the northern red-legged frog. The frog requires specific aquatic and riparian features. Adults require a dense, shrubby, or emergent riparian vegetation closely associated with deep (>2.3 feet) still or slow-moving water. The highest densities of California red-legged frogs have been associated with deep-water pools with dense stands of overhanging willows and an intermixed fringe of cattails. Breeding sites are located up to 85 feet from water in dense riparian vegetation. Nonbreeding sites can be found up to 98 feet from water in adjacent dense riparian vegetation (Rathbun et al. 1993). A final rule designating critical habitat identified a small sliver near Sweeney Ridge, San Mateo (UFWS 2006). A recent court decision eliminated critical habitat within the planning area

by changing the habitat definition. Critical habitat had been defined to include essential aquatic habitat, associated uplands, and dispersal habitat connecting essential aquatic habitat (NPS 2005a).

Tidewater Goby – Federal Endangered

The tidewater goby (*Eucyclogobius newberryi*) is a small benthic fish that occurs in the upper end of California coastal lagoons in salinities less than 10 parts per thousand. While generally found in coastal embayments, gobies are also known to occur in streams. In San Antonio Creek in Santa Barbara County, the goby is known to occur up to five miles upstream of the lagoon habitat. Within the planning area, tidewater goby is known only from Rodeo Lagoon in the Marin Headlands (NPS 2005a).

Chinook Salmon – Federal Threatened and Endangered; State Threatened and Endangered

Chinook salmon (*Oncorhynchus tshawytscha*) spawning and juvenile rearing habitat occurs in the Sacramento River and its tributaries, and large streams and rivers connected to the Pacific Ocean. Chinook salmon have unique populations with distinguishable “runs” based on the timing of upstream migration and their spawning period. Winter-run chinook are listed as endangered (federal and state). Central Valley spring-run chinook are listed as threatened (federal and state). Adult and juvenile migratory corridors exist along the San Francisco Bay portion of Golden Gate National Recreation Area lands. Critical habitat for winter-run chinook includes the San Francisco Bay to the Golden Gate Bridge.

Recent data indicate that most juvenile chinook salmon are using the Central Bay as a migratory corridor with most juvenile chinook moving along the northern corridor through Raccoon Strait and around the Tiburon peninsula, by Fort Baker, and out to the Golden Gate. Based on the occurrence of juvenile chinook at the Delta pumps and a one month transit time from Chipp's Island to the Golden Gate, winter-run chinook juveniles would be present near the Fort Baker area from January through June, while spring-run chinook juveniles would be present from March through June (MacFarlane 2002).

Coho Salmon – Federal Threatened and State Endangered

Coho salmon occur in several creeks within the planning area, as well as the nearshore waters of the Pacific Ocean and estuarine sites such as Bolinas Lagoon and San Francisco Bay. Coho salmon are found in Redwood Creek in Marin County. A single cohort of coho salmon was found in Easkoot Creek (Marin County). Coho are an anadromous species. They are born and reared in freshwater streams; as juveniles, they migrate to estuaries, adjust to saltwater, and then migrate to the ocean to mature into adults. Designated critical habitat for coho in Golden Gate National Recreation Area includes accessible estuarine and stream areas in the coastal watersheds of Marin County except areas above longstanding naturally impassable barriers. Optimal habitat conditions for juvenile coho seem to be deep pools created by rootwads and boulders in heavily shaded stream sections (NPS 2005a).

Steelhead Trout – Federal Threatened

Steelhead trout occur in several creeks within the planning area. Steelhead are found in Redwood Creek in Marin County, as well as in the drainages to Bolinas Lagoon and Rodeo Lagoon. In San Mateo County, steelhead are found in West Union Creek, a tributary to San Francisquito Creek. Like coho, steelhead are an anadromous species. Adult steelhead enter Golden Gate National Recreation Area streams in the late winter

through spring to reach spawning sites, typically well-aerated areas with small- to medium-sized gravel. Habitat preferences for juvenile steelhead are deep pools created by rootwads and boulders in heavily shaded stream sections, although young-of-the-year steelhead are often forced into shallow-water habitats. The amount of time steelhead rear in freshwater and marine/estuarine habitats is variable, ranging between one to three years. For most drainages, surveys have been conducted for presence or absence of salmonids, while in watersheds supporting coho salmon, abundance data on both species are available. The variable life cycle of steelhead makes population analysis more difficult, but also makes steelhead more resilient to adverse environmental conditions. In general, if the habitat requirements for coho were met, steelhead habitat requirements would also be met (NPS 2005a).

Designated critical habitat for steelhead in Golden Gate National Recreation Area includes the width of the stream channel defined by the ordinary high water line (U.S. Department of Commerce, NOAA 2005).

Northern Spotted Owl – Federal Threatened

Lands within Marin County support a northern spotted owl population of possibly 75 pairs. This population is isolated from spotted owl populations to the north by large areas of grassland and shrubs and constitutes the southern end of the subspecies range. Genetic analysis has shown low levels of genetic diversity within and low levels of gene flow between spotted owl populations in Marin County and Mendocino National Forest. The Marin County population supports the highest known density of northern spotted owls throughout their range. Threats to spotted owls in the planning area include urbanization, intense recreational pressure, disturbance from wildlife photographers and birders, genetic isolation, West Nile virus, possible catastrophic wildfire, expansion in the range of the barred owl (*Strix varia*), and habitat changes due to Sudden Oak Death.

Spotted owls in Marin inhabit coniferous forest, including second growth and remnant stands of Douglas-fir, bishop pine (*Pinus muricata*), coast redwood (*Sequoia sempervirens*), and mixed conifer-hardwood habitats comprised of tanoak, coast live oak (*Quercus agrifolia*), and California bay (*Umbellularia californica*).

Spotted owls tend to nest in older stands of conifer and hardwood trees that create a tall overstory. Spotted owls often select larger trees with defects, such as broken tops or mistletoe (*Arceuthobium spp.*) infestations, for nesting, but also have been found nesting in young bay trees in smaller stands. Preliminary pellet analyses indicate that spotted owls forage primarily on dusky-footed woodrats (*Neotoma fuscipes*) in addition to other forest dwelling small mammals and songbirds. Within the planning area, known spotted owl locations are currently limited to Muir Woods and the Stinson Gulch area (NPS 2005a).

San Francisco County

Chinook Salmon – Federal Threatened and Endangered; State Threatened and Endangered

Chinook salmon spawning and juvenile rearing habitat occurs in the Sacramento River and tributaries, and large streams and rivers connected to the Pacific Ocean. Chinook salmon have unique populations with distinguishable “runs” based on the timing of upstream migration and spawning period. Winter-run chinook are listed as endangered.

Central Valley spring-run chinook are listed as threatened. Adult and juvenile migratory corridors exist along the San Francisco Bay portion of Golden Gate National Recreation Area lands. Critical habitat for winter-run chinook includes the San Francisco Bay to the Golden Gate Bridge. See further description under Marin County. Chinook within the vicinity of Alcatraz Island are assumed to be present as migrating juveniles and adults. Research indicates that juvenile chinook salmon are using the Central Bay as a migratory corridor. The waters around Alcatraz Island have been designated as critical habitat for Chinook salmon (NPS 2001).

Western Snowy Plover – Federal Threatened

The Pacific Coast breeding population of the western snowy plover is federal listed as threatened. On March 22, 2004, the U.S. Fish and Wildlife Service determined that substantial information existed to support the possible delisting of the species, and a status review was initiated. This population of snowy plovers occurs along coastal beaches; they nest primarily on sand spits, dune-backed beaches, beaches at creek and river mouths, and salt pans at lagoons and estuaries. Snowy plovers nest in coastal Marin County. The western snowy plover occurs within the park at Ocean Beach and Crissy Field from mid-July through early May. Snowy plovers have been observed on rare occasions and for short periods of time (over a few days) at Rodeo Beach and overwintering on Ocean Beach; they have been periodically sighted at other beaches. Snowy plovers breed primarily on coastal beaches from southern Washington to southern Baja California, Mexico (NPS 2005a).

Bank Swallow – State Threatened

Bank swallows (*Riparia riparia*) are colonial nesters, nesting primarily in riparian and other lowland habitats west of the desert. Bank swallows require vertical banks or cliffs near streams, rivers, lakes, or the ocean; they need fine textured or sandy soils in which to dig nesting holes. Erosion by water and wind is important in creating and maintaining banks and bluffs suitable for nesting. Proximity to water is important at all seasons. During migration and in winter, wetlands provide a steady source of insects and a buffer against extreme temperatures. This species nests in the Fort Funston cliffs (NPS 2005a).

San Mateo County

Mission Blue Butterfly – Federal Endangered

See prior discussion under Marin County.

San Bruno Elfin Butterfly – Federal Endangered

The larval host plant for San Bruno elfin butterflies (*Callophrys mossii bayensis*) is *Sedum spathulifolium*, a succulent that grows on rocky, north-facing slopes along the coast (Lambert 2002). Adults are thought to stay within about 330 feet of host plants. Adults have one generation per year, with flight season from late February to early April. Eggs are laid on the ventral surface of the leaves of host plants. The fourth instar larvae pupate at the base of host plants where they remain through the summer, fall, and early winter. Habitat loss and trampling of host plants, larvae, and pupae are the primary threats to these butterflies. The San Bruno elfin butterfly is known to occur only at Milagra Ridge within the planning area (NPS 2005a).

San Francisco Garter Snake – Federal Endangered; State Endangered

The San Francisco garter snake (*Thamnophis sirtalis tetrataenia*) is endemic to the San Francisco peninsula and is currently restricted to localities within San Mateo County.

This listed species is primarily threatened by the loss and alteration of suitable wetland habitat due to urban development, freeway and road construction, illegal collection, agricultural practices, and trampling. It is considered semi-aquatic and is found along the margins of ponds, lakes, streams, and estuaries (above tidal influx). It feeds on small amphibians and fish, especially the federal listed threatened California red-legged frog (*Rana aurora draytonii*). The planning area contains three sites (Sweeney Ridge, Milagra Ridge, Mori Point / Sharp Park) that appear to have suitable habitat for the San Francisco garter snake; however, no recent surveys specifically designed to locate the snake and assess habitat have been conducted. Only Mori Point / Sharp Park has had a documented occurrence of the San Francisco garter snake; however, no recent population data are available (NPS 2005a).

California Red-legged Frog – Federal Threatened

See prior discussion under Marin County.

Steelhead Trout – Federal Threatened

Adult and juvenile steelhead trout migratory corridors exist along the San Francisco Bay portion of Golden Gate National Recreation Area lands for two listed population segments (California Central Valley and California Central Coast).

Marbled Murrelet – Federal Threatened; State Endangered

The marbled murrelet (*Brachyramphus marmoratus*) nests in old-growth forests or on the ground at higher altitudes where trees cannot grow. The marbled murrelet has experienced a decline in numbers due to loss of nesting habitat. This member of the auk family feeds at sea in pelagic offshore areas and inshore in protected bays.

Special Status Plant Species

The lands and waters of the park provide natural conditions for several special status plant species (i.e., federal and state listed species, species of special concern, candidate species). Fourteen plant species that are present in Golden Gate National Recreation Area are listed as threatened or endangered under the Endangered Species Act as amended (16 USC 1536 [a] [2] 1982). Of these, twelve are federal endangered and two are federal threatened.

Eleven of the plant species that are present in the park planning area are also listed as threatened or endangered by the California Endangered Species Act. Of these species, nine are state endangered, and two are state threatened. All but one of these state listed plant species (San Francisco popcornflower) are also federal listed.

Other plant species in the park planning area are also of management concern to the park and are listed by the California Native Plant Society on List 4 – “Plants of Limited Distribution” (locally rare). Although these species are not actually listed as threatened or endangered under the federal Endangered Species Act, NPS *Management Policies 2006* states that the National Park Service will inventory, monitor, and manage state listed and locally listed species in a manner similar to its treatment of federal listed species. Management policies also state that the Park Service will inventory other species that are of special management concern to parks such as locally rare, declining, sensitive, or unique species (NPS 2005a).

San Francisco Lessingia – Federal Endangered; State Endangered

The San Francisco lessingia (*Lessingia germanorum*) is federal listed as endangered. It is found in open sandy soils and dunes in coastal scrub. San Francisco Lessingia has historically been endangered by competition with invasive nonnative vegetation and native scrub vegetation, development, sand quarrying, trampling and recreational activities, incidental use of fertilizers, and other activities (NPS 2005a).

NATURAL RESOURCES – MUIR WOODS NATIONAL MONUMENT

INTRODUCTION

Muir Woods National Monument is a part of Golden Gate International Biosphere Reserve—one of the planet’s richest and most threatened reservoirs of plant and animal life. Muir Woods National Monument occupies 558 acres of the Central California Coast Range in Marin County, California, only a few miles north of San Francisco.

Muir Woods National Monument preserves one of the last remaining ancient redwood forests on the Pacific Coast and in the world. The monument was established in 1908 to protect a unique old-growth redwood forest. Specifically, it was created in recognition of the “extraordinary scientific interest and importance because of the primeval character of the forest in which the monument is located, and the character, age, and size of the trees” (Proclamation No. 793, Jan. 9, 1908, 35 STAT. 2174). These protected redwoods are the “last contiguous stand of old-growth coastal redwood (*Sequoia sempervirens*) and Douglas-fir in Marin County.” From its inception, the monument was designed to protect the “primeval character” of the redwood forests, and today, “ecological integrity” is a major driving force (Hall 2009).

The area surrounding Muir Woods National Monument is largely protected lands, including other units of Golden Gate National Recreation Area and lands managed by the state (Mount Tamalpais State Park) and by the Marin Municipal Water District. Muir Woods National Monument is located entirely within the watershed of Redwood Creek. Originating on Mount Tamalpais (over 2,400 feet in elevation), Redwood Creek flows through the heart of Muir Woods National Monument, bisects Frank Valley, and discharges into the Pacific Ocean at Muir Beach.

In addition to preserving the California Coast Redwood, Muir Woods National Monument is home to several federal endangered and threatened species, including the northern spotted owl, coho salmon, and steelhead trout.

PHYSICAL RESOURCES

Air Quality

Muir Woods National Monument is within a Class II air quality area and is located in the San Francisco Bay Air Basin. There are no air quality monitoring stations located at or near monument. Therefore, no specific data are available. See the Golden Gate National Recreation Area section for a description of monitoring information for the general area.

Carbon Footprint

See description under Golden Gate National Recreation Area.

Soils and Geologic Resources and Processes

Muir Woods National Monument is subject to many of the same geologic processes described for Golden Gate National Recreation Area. Slopes are inherently unstable. Intense shearing associated with faulting along the plate margin has reduced the strength of the rock. Ongoing uplift of the mountains causes continued erosion as the landscape strives to become stable. Surface disturbances, such as cuts for trails and roads, vegetation clearing, and alteration of surface water drainages, can trigger or lead to slope failures (NPS 2005a).

Auwaerter and Sears (2006, p. 18–19) describe the California Coast Range as

“a narrow band of low mountains along four hundred miles of coastline on the western edge of the North American tectonic plate... characterized by bedrock formed from ancient sea floor sediments and igneous rock that was heavily folded and uplifted due to lateral slipping along the juncture of the North American and Pacific plates.”

Within Muir Woods National Monument, elevations range from 120 to 1,340 feet above sea level. Redwood Creek loses approximately 50 feet in elevation from where it enters the monument on the north to where it exits approximately 0.5 miles downstream. Redwood Creek Canyon is the major topographical feature within the monument, and its hillslopes are quite steep, often exceeding 65%. These steep slopes provide considerable shade within the canyon. The monument extends a short distance into Kent Canyon on the northwest, and the newer additions on the southeast occupy a side canyon.

Soils

Based on the lands included within the monument in 1978, six soil complexes were identified within Muir Woods National Monument, which are distinguished by their soil type and slope. Howell et al. (no date) noted that the primary types are Centissima-Barnabe (derived from chert), basalt, and Franciscan formation sandstones. The Redwood Creek canyon floor is characterized as consisting of mostly “gray-podzolic soils” with clay-silt and clay-sand (Hall 2009).

Geology

Faulting and uplift in the Coast Range have left relatively unstable slopes subject to landslides and mass wasting. Valley bottoms have deep alluvial or colluvial fills. The mainstem alluvial valley fill in lower Frank Valley (about 4 miles downstream of the monument) is at least 37 feet deep, and may be locally as deep as 90 feet. Nearly half of the Redwood Creek watershed’s hillslopes are landslide deposits. There are outcrops of rock dispersed throughout the watershed, and in the headwaters, rocks have weathered to soils that can be very thin (<1 foot), although there are reports that soils in the upper Redwood Creek watershed can be as deep as 10 feet (Hall 2009).

Water Resources and Hydrologic Processes

Surface Water

The Redwood Creek watershed extends from Mount Tamalpais to Muir Beach. Redwood Creek is the dominant hydrologic feature within the Muir Woods National Monument. The Redwood Creek watershed encompasses approximately 8.9 square miles (including

Green Gulch Creek, which flows into Big Lagoon). Above the monument, the precipitous headwater tributaries of Redwood Creek (Fern, Spike Buck, and Rattlesnake) descend the steep south slope of Mount Tamalpais with many waterfalls. These upper tributaries flow through deep, steep canyons, with step-pool channel morphology. Redwood Creek, which is formed by the confluence of Bootjack and Rattlesnake creeks, flows through the heart of the monument for approximately 0.5 mile, being fed by several intermittent streams. Fern Creek, which originates on Mount Tamalpais, flows into Redwood Creek just within the northern boundary of the monument. Once Redwood Creek enters the monument, the channel flattens considerably, to less than a 2% grade, with a bed comprised of mixed gravel and cobble. During the 1930s, Redwood Creek within the monument was lined with rock revetments, and check dams were installed to channelize the creek and protect the old growth redwoods. Since this time, the check dams have been removed and the creek is being returned to a more natural state. Consequently, the section of Redwood Creek that flows through the monument has more riffles and fewer deep water pools than would occur in a highly natural creek with a similar slope (Hall 2009).

Below the monument, Redwood Creek is joined by Kent Canyon Creek as it flows through Frank Valley and becomes a relatively broad alluvial floodplain. This stretch has experienced significant impact from agriculture and pasturing and is incised and isolated from its floodplain. Below Frank Valley, the creek enters the ocean at Muir Beach, through a 2.2-acre intermittent tidal lagoon, typically referred to as “Big Lagoon,” which is also fed by Green Gulch Creek. During winter and spring the lagoon experiences tidal influences. As streamflow declines in late spring or summer, the beach berm builds up across the mouth of the creek, blocking surface flow from Redwood Creek to the Pacific Ocean and tidal exchange between the lagoon and Pacific Ocean. Lower Redwood Creek in the Muir Beach area has been altered through water diversions, agricultural levees, the construction of an NPS parking lot, and stream bank alterations. One outcome of this cumulative change has been significant aggradation of the channel (Hall 2009).

Groundwater and Municipal Water Use

Although most of the Redwood Creek watershed is managed as state and federal park lands, it also provides water for local firefighting, residential, and agricultural uses. Marin Municipal Water District stores water from springs in the upper watershed (upstream of the monument) for firefighting. Downstream of the monument, the Muir Beach Community Services District supplies the Muir Beach Community with water from a well near the creek, and Green Gulch Farm impounds and diverts flow in the Green Gulch subwatershed. Diversions in Big Lagoon have been abandoned, though the water right remains in place (Hall 2009).

Floodplains

Within Muir Woods National Monument, 100-year floodplains are located along Redwood Creek. As a result of natural weather events and the topography and soil characteristics of the area, runoff in the Redwood Creek watershed is high in the winter, with occasional flash floods. Two-year flood magnitudes are estimated at approximately 800 cubic feet per second (cfs), while the 50-year flood magnitude estimate is just over 4,000 cfs. However, during summer, flows are much lower—often below 1 cfs at the State Route 1 bridge—and many tributary streams are intermittent (NPS 2005b).

Water Quality

Water quality monitoring has been conducted at various times and with differing intensity within Redwood Creek and its tributaries. Monitoring has mostly been conducted outside of the monument because most inputs are from agricultural uses and other sources outside the monument. In 2005, Stillwater Sciences designed a water quality monitoring protocol for the watershed that can be used to isolate general areas of contaminant sources. This protocol was implemented once in 2005 as a baseline and may be implemented in future years depending on the availability of funding. A review of a history of water quality sampling in the watershed is compiled in the Existing Conditions Report for the Big Lagoon Wetland and Creek Restoration (Philip Williams & Associates 2003). Don Weeks (2006) issued the Water Resources Foundation Report, a background document on water resources that also identifies relevant laws and policies. Lendvay and Benning (2004) collected baseline water quality data, including pH, alkalinity, metals and ions, temperature, dissolved oxygen, nutrients, and turbidity, at five locations throughout the watershed. Their extensive study compares findings to an earlier, similar study by Madej (1989). In 2008, the Regional Water Quality Control Board established monitoring sites along the length of Redwood Creek as part of their Surface Water Ambient Monitoring Program that is focusing on benthic macroinvertebrates, periphyton, nutrients, and basic water quality parameters (Hall 2009).

Field surveys and aerial photograph analysis have been conducted to identify and quantify current and potential future sediment supply from roads, trails, culvert stream crossings, and (to some extent) bank erosion in the Redwood Creek watershed. Sediment sources were assessed for 27 miles of roads and 40 miles of trails, leading to recommendations for erosion control priorities to protect fish and other aquatic species within the watershed. These results were incorporated into a more comprehensive watershed sediment budget developed for the Lower Redwood Creek Restoration Project (Hall 2009).

Madej (1989) summarized water quality monitoring that was done between 1986 and 1989 in the lower Redwood Creek watershed (below the monument). Most metals were not detected, although there was one unusually high reading for copper (80 µg/L). Later reports attribute this to pesticide use, although this appears to be speculation (NPS 1991). Park staff report that this may have been related to the use of copper hoof treatment used at the stables, a practice that has been discontinued. Levels of coliform bacteria and nitrogen were high, evidently due to horse pastures and agricultural activities at Green Gulch Farm, as well as septic leach. Phillip Williams and Associates (1995) reported the lowest levels of nutrients and bacteria in the headwaters of Redwood Creek and the highest downstream of the monument; the number of organisms per 100 ml was 50 upstream of Banducci, 300 below Banducci, and 1900 at Pacific Way. Stillwater Sciences (2005) also report that NPS testing during the 1990s at Muir Woods National Monument found fecal coliform levels within the monument to be within California state thresholds (Hall 2009).

Several studies have found that temperatures in Redwood Creek are within the tolerances of salmonids. Lendvay and Benning (2004) reported temperatures across their sample locations to range from 10.8 to 11.0°C in early March and from 14 to 16°C in late April. They concluded that temperatures during spawning season should be cool enough for coho. Their study, conducted from March through April, found dissolved oxygen levels

to be adequate for insects and salmon. However, others have found dissolved oxygen levels to be reduced in Big Lagoon in the summer, and this is considered a “key factor” limiting juvenile fish survival (Hall 2009).

Lendvay and Benning (2004) determined that most water quality parameters were within EPA standards for aquatic life. Here pH ranged from 7.3 at Muir Beach to 8.0 at Bootjack Creek. Nitrate, though variable, was far below the standard of 90.0 mg/L, suggesting little concern about eutrophication. Somewhat high ammonia readings at specific sites on specific dates might suggest some concern, but the authors said that typical levels were well below the threshold for salmonids in most parts of the watershed. Sulfate levels were extremely low. This study found low levels of copper, in contrast to the levels reported by Madej (1989). Turbidity levels were high on sampling dates following storms, but quickly fell to levels within EPA standards. The low turbidity found in the Redwood Creek watershed suggests conditions suitable for salmonids, aquatic vegetation, and benthic macroinvertebrate populations (Hall 2009).

Other parameters reported by Lendvay and Benning (2004) were out of compliance with EPA standards. Alkalinity measures exceeded the EPA minimum standard for freshwater aquatic habitat of 20.0 mg/L (even the lowest reading, 42.8 at Fern Creek, was significantly above the standard). Phosphate readings, though highly variable, exceeded the guideline of 0.1 mg/L at every site. Aluminum concentrations exceeded the recommended limit for fish at all sites on one date and at two sites on other dates, and the authors concluded that “aluminum may be a threat to aquatic species in Redwood Creek.” Similarly, zinc concentrations were frequently above the EPA limit for freshwater ecosystems, indicating possible negative effects (Hall 2009).

Overall, Lendvay and Benning (2004) conclude that the water quality of Redwood Creek is excellent. Despite the fact that some parameters were elevated, in the context of other parameters such as very healthy benthic macroinvertebrates, these do not seem to be posing significant threats (Hall 2009).

BIOLOGICAL RESOURCES

The majority of Muir Woods National Monument (approximately 80%) is occupied by old-growth coastal redwood/Douglas-fir forests in uneven aged stands (NPS 2005b). Although it is difficult to age old-growth redwoods, individual trees on alluvial flats in the monument are estimated to be as much as 1,000 years old.

Muir Woods National Monument is located within the center of the California Floristic Province, one of only five regions in the world with a Mediterranean climate. At the landscape scale, plant associations are shaped by aspect, marine influence, and elevation (NPS 2005a). Generally, within the San Francisco Area Network, the three provinces represented are the California Coastal Chaparral Forest and Shrub; the California Dry Steppe; and the California Coastal Steppe, Mixed Forest and Redwood Forest. The redwood forests of Muir Woods National Monument fall within the last of these, while around the edges of the monument are small patches of other plant communities that are much more common in parts of Mount Tamalpais and the Marin Headlands (NPS 2005a). To the southwest is coastal scrub dominated by coyote brush, grasses and forbs; and to

the northeast is a mosaic of coast live oak, California bay, and chaparral. At the south end of the monument, the Redwood Creek riparian area loses the redwoods and becomes dominated by deciduous trees like red alder and broadleaf evergreen trees such as California bay and tanoak (Hall 2009).

The monument provides important habitat for federal listed threatened or endangered species, namely northern spotted owls, coho salmon and steelhead, and several species of bats that are listed as sensitive species. All of these species breed within the monument. Redwood Creek has been identified as “a high priority restoration area for coho salmon” under the California Department of Fish and Game’s 2004 Recovery Strategy. While suitable marbled murrelet habitat has been identified in the monument, there has been no confirmation that this species uses the park for breeding (Hall 2009).

Habitat (Vegetation and Wildlife)

Plant Communities

Muir Woods National Monument is the most intact old-growth coastal redwood forest in the Bay Area. It is estimated that nearly 2 million acres of forest similar to those in Muir Woods National Monument once covered a narrow strip along the coasts of California and Oregon. Today, 97% of this area has been impaired or altered and most coastal redwoods now grow in protected second and third growth forests or managed timber plantations. Muir Woods National Monument remains as a very accessible yet prime example of an old-growth forest.

Sudden Oak Death is a common name given a pathogen (*Phytophthora ramorum*) responsible for widespread tree death throughout northern and central California. This pathogen first appeared in Muir Woods National Monument during the mid-1990s, and although many plants in the redwood forest are affected, the tanoaks have suffered the most.

“NPSpecies,” a National Park Service database, documents 263 vascular plant species present in the monument. Approximately 29 other species are probably present, but have not been verified, and 17 species are unconfirmed. Forty-four species are listed as historic, meaning they were previously present but are believed to be extirpated. The basis for this determination is staff knowledge of the site, although no field inventory of plants has yet been completed. A 1966 lichen inventory identified 7 fruticose lichens, 9 foliose lichens, and several unidentified species of crustose lichens (Hall 2009).

There do not appear to be many native plant species of concern in the monument. The 1980 general management plan (NPS 1980) identified the San Francisco wallflower (*Erysimum franciscanum* var. *franciscanum*) and Presidio clarkia (*Clarkia franciscana*) as being species of special status, but no further mention is made of these in subsequent planning documents, and they are not mentioned in current lists of species of management concern. They have never been documented within the monument and evidently their inclusion on the list and in the 1980 plan was an error. Oakland star tulip or mariposa lily (*Calochortus umbellatus*) is described in the fire management plan (NPS 2005a) as a California Native Plant Society listed species, which has been found “in the vicinity of Muir Woods” in grasslands. Additionally, the California bottle-brush grass (*Elymus californicus*) is a federal species of concern; this species prefers coniferous

forests and riparian woodlands, and has been documented in the monument (NPS 2005a). The only active management for rare plant species within the monument has been some fencing along the valley floor to protect the California bottle-brush grass, which appears to have been effective (Hall 2009).

Coast Redwood / Douglas-fir Forests

As noted earlier, most of the monument is comprised of mixed age coast redwood and Douglas-fir (NPS 2005a). In the monument, the redwood forest “extends along the canyon floor north beyond the monument, across most of the northeastern-facing canyon wall up to the Dipsea Trail, and along portions of the lower southwest-facing wall and adjoining side canyons extending to the Ocean View Trail. In these areas, the redwoods thrive in a cool microclimate with loamy soils and ample moisture from fog, rain, and groundwater” (Hall 2009).

Although this forest is largely isolated within the larger landscape, due to natural conditions such as physiography and the restricted environmental requirements of redwoods, as well as logging and conversion of lands in the surrounding area, the tracts of forest within the monument have had a serendipitous history of protection that has preserved many of the structural and functional ecological features. The monument’s redwood forests were never logged (McBride & Jacobs 1978), although logging did occur in Conlon Canyon. While it is true that substantial impacts were historically imposed by recreation and tourism (e.g., trampling, campfires, and collecting plants) and park management (e.g., stream alteration, removal of woody debris), it is possible to recover from some of these impacts within a period of years or decades. Indeed, studies have shown that areas formerly devoid of vegetation along Redwood Creek have recovered to the point that it is not possible to discern restoration plantings from natural vegetation. On the steep hillsides away from Redwood Creek, it appears that impacts to ecosystems were even more limited. Stillwater Sciences (2005) noted that “understory cover today is probably the most extensive that it has been in a century.” National Park Service staff considers the health of the redwood forest to be good. Public ownership of surrounding lands is an aspect that helps maintain certain ecosystem functions within the monument’s redwood forests.

Other Terrestrial Vegetation Types

Outside the redwood and Douglas-fir forests, there are small patches of other vegetation types in the monument that are much more extensive in other parts of the watershed outside the monument. McBride and Jacobs (1978) described five vegetation types: hardwoods, brush, grassland/brush, hardwood/brush, and grassland. These include the habitat types identified in the fire management plan (NPS 2005b) as native hardwood, coastal scrub/chaparral, grassland, nonnative evergreen, and developed. While the redwood forests are largely intact or recovering, these other habitat types have been more extensively altered (Hall 2009).

The native hardwood forest (or mixed hardwoods) covers 800 acres of the Redwood Creek watershed (Stillwater Sciences 2005), of which only 59 are within Muir Woods National Monument. These forests have not been well studied. In places like the Monte Vista tract in the Camino del Canyon and Camp Hillwood areas, where development and residential uses have occurred, the hardwood forests have been substantially reduced in extent. Presumably, under NPS management, these areas will begin to return to a more natural state, although there are concerns about invasive species such as eucalyptus,

which can dramatically alter forest structure and composition. In areas along Camino del Canyon, various landscape plants have escaped, and invasive exotics such as yellow starthistle (*Centaurea solstitialis*) and French broom (*Genista monspessulana*) are problems. Additionally, the native hardwoods are at great risk from sudden oak death (Hall 2009).

The remaining native vegetation types—coastal scrub/chaparral and grassland—have been highly altered, due to a combination of fire suppression, land use practices, and invasion by nonnative species (Stillwater Sciences 2005; NPS 2005b). The coastal scrub/chaparral occurs at upper elevations, and seems to be invading grasslands as a result of fire suppression (NPS 2005a). In turn, coniferous forests are invading the lower elevations of the scrublands. Within the Redwood Creek watershed, most native grasslands, which occupy ridge tops and slopes, have become dominated by nonnative, Mediterranean annual grasses (Stillwater Sciences 2005).

Invasive Plants

Invasive exotics are a considerable problem within all other habitat types. In fact, approximately one-third of the plants (108 species) identified within the monument are nonnatives, many of which are landscape plants found in the Monte Vista additions.

Within the redwood forests, McBride and Jacobs (1978) identified three exotic forbs, but considered them to be rare and not a threat. There are isolated patches of exotic aquatic plants, but these seem to be limited in extent and are relatively stable. Today, there are two main exotic species of concern in the riparian redwoods: the forget-me-not (*Myosotis sylvatica* and *Myosotis latifolia*) and panic veldtgrass (*Ehrharta erecta*). Originally introduced to “improve” the aesthetics of the forest, forget-me-nots quickly spread throughout the monument. Fortunately, diligent work by park staff and volunteers has kept this species in check along the canyon floor, although there is concern about the ability to eliminate it from steep, inaccessible slopes. Along Redwood Creek, removal of this species has led to an increase in native plant cover. Outside the riparian forests, the park has worked to eliminate other invasive species, including cape ivy, brooms (*Genista monspessulana*, *Cytisus scoparius*, *Spartinum junceum*), acacia (*Acacia melanoxydon*, *Acacia decurrens*), and other species (Hall 2009).

Aquatic Systems

The major ecosystem elements within the monument that have been altered include the aquatic and riparian systems. For decades, concerted efforts were made to “clean up” the Redwood Creek valley to alleviate problems with flooding and provide an aesthetically pleasing visitor experience. This amounted to removing woody debris from the forests and engineering the creek to create a more consistent gradient and protect its banks from erosion. Most of this was a result of intensive Civilian Conservation Corps (CCC) work during the 1930s, when Redwood Creek within the monument was leveled and rock revetment was installed (Auwaerter & Sears 2006; Stillwater Sciences 2005). The revetment occupies 57% of the total stream bank length (3,541 feet) within Muir Woods National Monument. As late as the early 1990s, woody material was being removed from the stream to prevent logjams that might increase flooding. Channelization has decreased flooding and, consequently, deposition. It has also drastically altered instream morphology, reducing the number and depth of pools and eliminating undercut banks (Fong 2002). Fong’s survey showed that pools occupied only 32% of that portion of Redwood Creek within the monument, with flatwater or shallow riffles being much more

extensive. In summer, some riffles become so shallow that fish are forced downstream. A survey in 2003 showed a lower biomass of salmonids was associated with the presence of riprap. The channel immediately downstream of the monument's boundary, where riprap was never installed, appears more natural than the area within the monument. However, Redwood Creek within the monument has the least amount of fine substrate and more riffles, and therefore the largest number of spawning areas (Hall 2009).

Other impacts to Redwood Creek, both upstream and downstream of Muir Woods National Monument, have impacted ecosystem functions. Sedimentation from upstream associated with roads and culverts have impacted the entire length of the creek. However, sedimentation from roads and culverts is not the major player in channel habitat downstream of the monument. The watershed sediment budget identified and quantified sediment sources to Redwood Creek for three historical periods and included future projections. In the recent past, channel incision was the largest source of sediment to the creek downstream of the monument (57% of total supply from 1921 to 1980). As channel incision slows or ceases, erosion from roads and trails is expected to contribute 23% to total sediment yield in the lower creek. In addition to roads and trails, future sediment sources include hillslope erosion (19%), tributary bank erosion (29%), and channel incision (28%). Additionally, changes at Lower Redwood Creek at Muir Beach appear to have had a significant impact on habitat characteristics necessary for salmon, steelhead, and red-legged frogs. Nevertheless, despite its degraded condition, Lower Redwood Creek appears to be a major holding area for run-back steelhead adults, and its important ecological role has led to it being a high priority for restoration (NPS 1999b; NPS and Marin County 2007; Hall 2009).

Philip Williams and Associates (1995) characterized the Redwood Creek watershed as a whole as

“unique among California coastal watersheds of its size in that it remains largely undeveloped and is protected as state and federal park lands. The creek has largely recovered from historical grazing activities in the watershed, and now supports sustainable populations of coho salmon.”

Thus, there clearly have been alterations to cover and habitat that have influenced ecological functioning. However, within the larger landscape, the Redwood Creek watershed is a primary target for restoration and maintenance of important habitats. The facts that there are no impoundments, except in the Green Gulch subwatershed (Martin 2000; Philip Williams & Associates 2003) that would severely fragment habitat, and most watershed land is in local, state, or federal government ownership, create opportune conditions for protection (Hall 2009).

Wildlife

Within the Redwood Creek watershed, riparian woodlands provide breeding habitat and forage for 85 bird species and 16 mammal species. Two mammals, the shrew-mole and the broad-footed mole, were found only in this habitat. Nineteen of the bird species and one mammal are species of management concern. Cape ivy—which is present in the Monte Vista tract but not yet in the redwoods—has had documented impacts on the diversity of bird species (Hall 2009).

Redwood / Douglas-fir forest in the Redwood Creek watershed provide habitat for 30 bird species and 20 mammals. Hall observed that “this habitat supports an average-to-

high bird diversity and low bird abundance compared to other habitat types in the watershed.” Mammals that are preferentially associated with these forests include deer mouse (*Peromyscus maniculatus*), gray fox (*Urocyon cinereoargenteus*), opossum, trowbridge shrew (*Sorex trowbridgii*), Sonoma chipmunk (*Tamias sonomae*), western gray squirrel (*Sciurus griseus*), and raccoon (*Procyon lotor*) (Howell et al. no date); 17 species of concern (4 bats and 13 birds) have been detected in this habitat type (Hall 2009).

Mammals

According to NPSpecies, 27 mammal species are confirmed present in Muir Woods National Monument, while 9 are unconfirmed. Domestic and feral cats, local dogs, and turkeys are presently considered pests. None of the mammals is considered at risk of exploitation. Howell et al. (no date), in a mammal survey, documented black-tail deer (*Odocoileus hemionus*), meadow vole (*Microtus pennsylvanicus*), and opossum, which do not appear in the NPSpecies list. Additionally they documented domestic dogs (“unconfirmed” in NPSpecies) and western spotted skunk (*Spilogale gracilis*) (“false report” in NPSpecies). NPSpecies lists no “historic” (extirpated) species, but various historic documents suggest that several large mammals, like bears, were historically present but disappeared as long ago as the late 1800s. The NPSpecies data provide no information on nativity, abundance, or residency for the mammals in the monument (Hall 2009).

Among the mammal species, bats have received significant investigation. Habitat for bats in Muir Woods National Monument is considered high-quality, and the diversity of species is notable—Heady and Frick (2004) reported 10 species foraging and/or roosting in the monument; this number represents 69% of the species that are likely to occur in the region. Redwoods are particularly good habitat because they provide hollows and crevices for roosting. The Townsend’s big-eared bat (also called the Pacific western big-eared bat) occupies humid coastal regions of California, roosting in caves, mines, buildings, and fire scars (NPS 2005a). It is very sensitive to disturbance and suffers from a lack of suitable roosting sites; because of their large cavities, large diameter redwoods offer some of the only suitable habitat. The fringed myotis occurs in a wide variety of habitats, although it prefers foothill hardwoods and hardwood-conifer forests and has been considered preferentially associated with redwood forests. The long-legged myotis is most common above 4,000 feet in elevation in primarily coniferous forest habitats. It uses trees as day roosts and creates nursery colonies in hollow trees. This has led to increased protection of fire scars. The Yuma myotis prefers open woodlands and forests, and requires still water sources that attract prey insects. It is quite tolerant of human habitation. Little is known about the western red bat (U.S. Forest Service sensitive species), although it is known to roost in cottonwoods and willows and is thought to be migratory (Hall 2009).

Birds

Over 50 species of birds have been identified in Muir Woods National Monument over a year's time. Their abundance and periods of song vary with time of day, season, and weather conditions. A deep, wooded redwood canyon is a specialized habitat. Although this old growth forest supports spotted owls and pileated woodpeckers (*Dryocopus pileatus*), the overall lack of food is the primary reason for the apparent scarcity of birds.

There are few insects in a redwood forest, as the tannin repels insects and the deep shade limits the number of flowers and fruits produced.

In addition, federal threatened northern spotted owls nest in coniferous and mixed-hardwood forests surrounding Muir Woods National Monument. The monument also contains potential marbled murrelet habitat, but no breeding murrelets have been detected in two years of surveys.

The following quotation from the superintendent's annual report for 1923 indicates little change during the past 80 years in the bird life found in Muir Woods:

"Birds, as is generally the case in a redwood forest, are conspicuous by their absence—Steller's jays being the only bird seen in any numbers."

Fifty-nine bird species are confirmed present in the monument, according to NPSpecies, although the 1999 resource management plan indicated that "at least 69 bird species occupy Muir Woods" (NPS 1999b). Seven are migratory species, and 23 are known to breed within the monument. The only federal listed threatened species is the spotted owl, which breeds in and near the monument. Although Muir Woods National Monument appears to provide habitat suitable for marbled murrelets, which nest only in redwood trees, none have been detected, despite a focused inventory. Appendix D, which provides detailed information about all special status species, lists two State Species of Concern in Muir Woods National Monument: Cooper's hawk (*Accipiter cooperi*) and sharp-shinned hawk (*A. striatus*). Inventories in 2000 did not detect either hawk species. However, Allen's hummingbird (*Selasphorus sasin*) and hermit thrush (*Catharus guttatus*)—both species of management concern—were observed, as well as the chestnut-backed chickadee (*Parus rufescens*), which is on the Audubon watch list. According to their point count data, the Pacific-slope flycatcher (*Empidonax difficilis*), a species of management concern, was the most common bird; it was observed at 93% of the census points. The other most common species were winter wrens (65%), chestnut-backed chickadees (56%), golden-crowned kinglets (54%), brown creepers (47%), and dark-eyed juncos (30%) (Hall 2009).

Amphibians and Reptiles

NPSpecies lists five amphibians as present within the monument along with two species that were documented historically, but are no longer present, the foothill yellow-legged frog and yellow-eyed ensatina (*Ensatina eschscholtzii xanthoptica*). Yellow-legged frogs were collected in 1954, but they were not found in 1993 within the monument, and Hall noted that this species is "now very rare or absent" in areas where it formerly was abundant. Very little information is available about the abundance or status of many of these amphibian species (Hall 2009).

The nonnative signal crayfish has long been established in Redwood Creek and Fern Creek. It is the only nonnative aquatic species in the monument. It is possible that this species displaced the native sooty crayfish (*Pacifastacus nigrescens*) (Hall 2009).

The California giant salamander is found from Sonoma to Santa Cruz county, particularly in humid coastal conifer forests. A recent survey found that salamander larvae were rare in the main stem of Redwood Creek, but more abundant in tributaries. Fong and Howell noted that the signal crayfish and giant salamander were rarely found together in any stream habitat type, but they were unable to determine whether the crayfish were displacing the salamanders from preferred habitats. They noted that, because crayfish

tend to favor pools, actions that might be taken to restore stream features such as pools could increase the abundance of crayfish (Hall 2009).

NPSpecies lists 12 reptile species as present within Muir Woods National Monument. The abundance, residency, and nativity of most of these species are unknown. Very little is reported about any of these species in any planning or research reports. However, the Pacific (western) pond turtle (*marmorata*, formerly *Clemmys marmorata*), a federal species of concern, is listed as present in the monument, although none of the recent aquatic habitat assessments make mention of it (Hall 2009).

Fish

An old-growth forest is very interconnected; through time, many of the plants and animals become reliant on one another. One example at Muir Woods National Monument is found in Redwood Creek. The redwoods depend on the creek for most of their water and the trees help keep the gravel in the creek clean by stabilizing the soil. The trees also help keep the temperature of the stream cool and constant. As the trees die and fall into the creek, they create pools and enrich the stream with their nutrients. Because salmon need clean gravel, constant water temperature, and pools for spawning, Redwood Creek provides good habitat for salmon. It is one of the last streams in California to have its native stock of salmon, due largely to the undisturbed forest surrounding it. Both coho salmon and steelhead trout are found in Redwood Creek.

There are four native fish species present in the monument, although additional species, including some nonnative fish, occupy lower reaches of Redwood Creek. The two most significant species—targets of extensive monitoring—are coho salmon (recently upgraded federally to endangered status) and steelhead (federal listed as threatened). Redwood Creek is critical habitat for both; Muir Woods National Monument provides good spawning habitat but, due to loss of pools and structure, juvenile rearing habitat is very limited. Both runs have been considered stable, although significantly reduced from historic times (Hall 2009).

The Redwood Creek coho are part of the Central California Evolutionarily Significant Unit (ESU), found in three watersheds in the Park Service's San Francisco Bay Area Network (NPS 1999a). However, genetic analysis shows that the coho in Redwood Creek are a genetically distinct subgroup that is not closely related to other coho in the same ESU (NPS and Marin County 2007). Spawning occurs between December and February, depending on when storm flows increase enough to permit returning adults to breach the sandbar at Big Lagoon. Emergence occurs in March and April, and the juveniles remain in fresh water for approximately 15 months, before heading to the ocean for 16 months. This cycle creates three "year-classes" of fish; for instance, the fish returning to spawn in 2007 and 2008 were from the 2004/2005 year class. Given their lifecycle, habitat requirements vary; fish need habitat for spawning, juvenile rearing and migration, growth to adulthood, and adults need migration corridors (NPS and Marin County 2007). Juvenile rearing habitat with refugia and shelter appears to be especially limiting in Redwood Creek. Big Lagoon's altered environment does not provide high-quality salmonid-rearing habitat (Hall 2009).

Nonnative Wildlife

A few nonnative mammals have been of concern to the monument. In the past, feral hogs were widespread in Golden Gate National Recreation Area (including Muir Woods National Monument), but they have been largely controlled (NPS 1999b). They can

seriously degrade habitat, disturb soils, compete for food, and transmit diseases. Feral cats and domestic dogs (unconfirmed), though not major concerns, can present problems for native wildlife (Hall 2009).

There have been anecdotal reports of chukars (*Alectoris chukar*), an exotic species, near but not yet within the monument. Also, wild turkeys are considered nonnative and increasing in and around Muir Woods National Monument. This species was introduced by California Department of Fish and Game for hunting, but Golden Gate National Recreation Area considers it invasive and uncontrolled. It competes with native species for food and has been known to harass people. National Park Service staff are contemplating small pilot removals (Hall 2009).

Special Status Species

Coho Salmon – Federal Threatened; State Endangered

Coho salmon occur in several creeks within the planning area, as well as the nearshore waters of the Pacific Ocean and estuarine sites such as Bolinas Lagoon and San Francisco Bay. Coho salmon are found in Redwood Creek in Muir Woods National Monument. A single cohort of coho salmon was found in Easkoot Creek (Marin County). Coho are an anadromous species; born and reared in freshwater streams, as juveniles they migrate to estuaries, adjust to saltwater, and then migrate to the ocean to mature into adults.

Designated critical habitat for coho in Golden Gate National Recreation Area includes accessible estuarine and stream areas in the coastal watersheds of Marin County except areas above longstanding naturally impassable barriers. Optimal habitat conditions for juvenile coho seem to be deep pools created by rootwads and boulders in heavily shaded stream sections (NPS 2005a).

See previous discussion under Golden Gate Natural Recreation Area.

Steelhead Trout – Federal Threatened

Steelhead are found in Redwood Creek which flows through Muir Woods National Monument, as well as the nearshore waters of the Pacific Ocean and estuarine sites such as Bolinas Lagoon and San Francisco Bay. Like coho, steelhead are an anadromous species. Adult steelhead enter Golden Gate National Recreation Area streams in the late winter through spring to reach spawning sites, typically well-aerated areas with small- to medium-size gravel. Habitat preferences for juvenile steelhead are deep pools created by rootwads and boulders in heavily shaded stream sections, although young-of-the-year steelhead are often forced into shallow-water habitats. The amount of time steelhead rear in freshwater and marine/estuarine habitats is variable, ranging between one and three years. For most drainages, presence/absence salmonid surveys have been conducted, while in watersheds supporting coho salmon, abundance data on both species are available. The variable life cycle of steelhead makes population analysis more difficult, but also makes steelhead more resilient to adverse environmental conditions. In general, if the habitat requirements for coho were met, steelhead habitat requirements would also be met (NPS 2005a).

In April 2002, the U.S. District Court for the District of Columbia approved a National Marine Fisheries Service consent decree withdrawing a February 2000 critical habitat designation for steelhead trout. Designated critical habitat for coho includes all accessible

estuarine and stream areas in the coastal watersheds of Marin County except areas above longstanding, naturally impassable barriers. Through this designation, NOAA-Fisheries identified ten essential features of critical habitat: substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, and safe passage conditions (NPS 2005a).

See previous discussion under Golden Gate Natural Recreation Area.

Northern Spotted Owl – Federal Threatened

Marin County supports a northern spotted owl population of possibly 75 pairs. This population is isolated from spotted owl populations to the north by large areas of grassland and shrubs and constitutes the southern end of the subspecies range. Genetic analysis has shown low levels of genetic diversity within and low levels of gene flow between spotted owl populations in Marin County and Mendocino National Forest. The Marin County population supports the highest known density of northern spotted owls throughout its range (NPS 2005a).

Spotted owls tend to nest in older stands of conifer and hardwood trees that create a tall overstory. Spotted owls often select larger trees with defects, such as broken tops or mistletoe infestations, for nesting, but also have been found nesting in young bay trees in smaller stands. Preliminary pellet analyses indicated that spotted owls forage primarily on dusky-footed woodrats (*Neotoma fuscipes*) in addition to other forest dwelling small mammals and songbirds. Within the planning area, known spotted owl locations are currently limited to Muir Woods National Monument and the Stinson Gulch area (NPS 2005a) (see discussion under Marin County).

Northern spotted owls within the monument are at the southernmost extreme of the species range, and the population in Marin County is genetically isolated, although relatively large; 161 distinct nests were documented between 1998 and 2003 (Stillwater Sciences 2005). This species was listed at the federal level as threatened in 1990. Monitoring in the county over the past several years has shown stable fecundity, with approximately 0.5 female young fledged per breeding female and nearly 90% of nests being occupied for the past several years. Old redwood forests are important nesting habitat; 43% of nests in Marin County are in redwood trees and 36% are in Douglas-fir trees. Across northern California, owls were found to select locations with large diameter conifer overstory and an understory of large hardwoods. The mean diameter of platform nest trees in Marin County is 36 inches. Two pairs have historically nested within Muir Woods National Monument or immediately adjacent to the monument (Hall 2009).

There are several threats to spotted owls in the region, although the habitat conditions within the monument itself are presently of high quality. Urban development destroys habitat, owls are especially susceptible to West Nile virus (first confirmed in Marin County in 2005), and Sudden Oak Death may affect both nesting habitat and prey species. Additionally, there are anecdotal reports of people disturbing nests and luring owls with mice. Finally, the barred owl is suspected of displacing spotted owls in Marin County. This species, once limited to the eastern United States, has been extending its range over the past century and is now found throughout the Pacific Northwest and in California. Aggressive behavior toward spotted owls has been documented in Marin County, and in 2005, a male barred owl was detected in the monument for the fourth year in a row, which coincided with the second year of spotted owl nest failure in the

monument. In 2007, the first breeding pair of barred owls was observed, and breeding was observed again in 2008 (Hall 2009).

Kelly et al. (2003) conducted extensive historical analysis of the location of spotted owl and barred owl territories at five study areas in Oregon and Washington from 1987 to 1999. The study concluded that there had been a steady increase in the number of barred owls at all long-term spotted owl monitoring sites, and that when barred owls invade, the occupancy of territories by spotted owls declines significantly. The study concludes that “land managers and regulatory agencies should regard barred owls as a threat to spotted owls.” There is some debate about whether the barred owl in Muir Woods National Monument should be considered native or not (it is listed as such in NPSpecies, but other park planning documents list it as invasive and uncontrolled). Nevertheless, barred owls have been identified as the primary threat to spotted owl recovery in the U.S. Fish and Wildlife Service’s final recovery plan. National Park Service staff consider the barred owl to be a species of concern, and feel a need to track and potentially manage the species due to its potential impact on spotted owls. It appears that the presence of the breeding barred owls in the monument has displaced the historically nesting spotted owls (Hall 2009).

Marbled Murrelet – Federal Threatened; State Endangered

See description in the discussion of habitat in San Mateo County.

CULTURAL RESOURCES – GOLDEN GATE NATIONAL RECREATION AREA

INTRODUCTION

Golden Gate National Recreation Area is home to a remarkable constellation of cultural resources, among the most diverse in the entire national park system. A cultural resource may be a tangible entity or a cultural practice. For NPS management purposes, tangible cultural resources are categorized as districts, sites, buildings, structures, and objects for the National Register of Historic Places, and as archeological resources, cultural landscapes, structures, museum objects, and ethnographic resources. The park includes more than 700 historic structures, and the park's planning area covered by this general management plan includes 5 national historic landmarks, 2 national historic landmark nominations presently in draft, 13 properties listed in the National Register of Historic Places, and 6 properties determined eligible for national register listing; most are related to military and maritime commercial themes stretching over a period of more than 200 years, with many pre-contact archeological resources associated with the Coast Miwok and Ohlone cultures extending back thousands of years. See Table 5 for a listing of these properties.

The park's nationally significant seacoast fortifications and military installations span the Spanish, Mexican, and American eras and illustrate the military architectural and engineering heritage of the United States and the broad patterns of the nation's history. Other cultural resources include an array of buildings, sites, and features that reflect the local and regional historical industrial, commercial, and recreational development of the San Francisco Bay Area, including the bay's European discovery (San Francisco Bay Discovery Site National Historical Landmark); maritime-related resources such as historic lighthouses, shipwrecks, wharves, piers, docks, and other shoreside embarkation points; and remnants of the area's historic ranching, agricultural, logging, and mining activities.

Some 370 archeological sites have been inventoried, including properties constituting the tangible connection between the Coast Miwok and Ohlone communities and park lands. Historic archeological properties constitute significant, yet incompletely documented, elements of existing national historic landmarks, national register listed properties, and cultural landscapes. Nine documented cultural landscapes in the park include rural landscapes and dairy ranches. Remnants associated with agricultural pursuits that were carried on by the same families for generations remain extant in the park, comprising a rich legacy of folkways, rural landscapes, and architecture.

Alcatraz Island, a 22.5-acre island in San Francisco Bay is best known for its reputation as the maximum security, minimum-privilege federal penitentiary that housed some of America's most notorious criminals between 1934 and 1963. However, the island also contains layers of history from its prior uses as a military fort, military prison, federal penitentiary, and as the site of the occupation by Indians of All Tribes from 1969 to 1971.

Although numerous cultural resource studies have been undertaken for Golden Gate National Recreation Area, the park's cultural resource surveys are limited for some significant resource types. Less than 10% of the park has been surveyed for archeological resources. Fifteen cultural landscapes have been identified in the park, but only nine have been inventoried or evaluated. Detailed surveys for archeological, cultural landscape, and ethnographic resources, as well as historic resource studies, national register eligibility determinations, and inventory updates for the park's List of Classified Structures (LCS), Cultural Landscape Inventory (CLI), and Archaeological Sites Management Information System (ASMIS) will provide critical information needed for park planning and historic property preservation.

Golden Gate National Recreation Area includes recently acquired lands in San Mateo County, which are the subject of a recently completed historic resource study that further identifies historic properties and themes associated with these park lands. The primarily Spanish colonial and Mexican settlement history and the agricultural, military, maritime and transportation themes of the area are not dissimilar to those of other park lands, and evidence of numerous prehistoric sites, both inside and adjacent to park lands, suggest important opportunities for joint stewardship between the park and its neighbors.

AREA OF POTENTIAL EFFECT (APE)

Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effects of their undertakings on historic properties. The Advisory Council on Historic Preservation (ACHP) regulations that implement section 106 require that impacts to historic resources be identified and evaluated by determining the area of potential effects (APE) and by identifying cultural resources present in the area of potential effects that are either listed in or eligible for listing in the national register (36 CFR Part 800, "Protection of Historic Properties"). The area of potential effect is the geographic area or areas within which an undertaking may directly or indirectly cause alterations to the character or use of historic properties, and it is influenced by the scale and nature of an undertaking. The area of potential effects encompasses both those areas where proposed actions might occur that would directly impact cultural resources, as well as adjacent areas that contain resources that might be indirectly affected (see figure 6). The area of potential effects for this general management plan was discussed in a meeting between the National Park Service and the California state historic preservation office on March 16, 2010 and is generally defined as the park boundary and those properties adjacent to the park boundary where potential indirect impacts may occur. A description of the resources within the area of potential effects follows and is organized by National Register of Historic Places properties, resources that are either eligible or in need of a determination of eligibility for listing in the national register, archeological resources, and ethnographic resources. See the following table for a listing of these properties.

Table 5: Area of Potential Effect

HISTORIC PROPERTIES WITHIN THE PARK BOUNDARY (By County, Alphabetically)				
RESOURCE	COUNTY	LISTED ON NATIONAL REGISTER	NATIONAL HISTORIC LANDMARK	AREAS OF SIGNIFICANCE
Alcatraz Island	San Francisco	Yes	Yes	Social History, Engineering, Military, Commerce (District), Historic Archeology
Camera Obscura	San Francisco	Yes	No	Engineering (Structure)
Fort Mason Historic District	San Francisco	Yes	No	Architecture, Military, Transportation, Landscape Architecture (District), Historic Archeology
Fort Miley Military Reservation	San Francisco	Yes	No	Military (District)
Fort Point National Historic Site	San Francisco	Yes	Yes	Architecture, Maritime History, Military, Historic Archeology
Golden Gate Bridge	San Francisco, Marin (owned by Golden Gate Bridge District, on parkland)	Eligible	Eligible	Engineering, Transportation History
King Phillip and Reporter Shipwreck Site	San Francisco	Yes	No	(Naval) Architecture, Transportation, Commerce, Maritime History
Merrie Way Stands Site	San Francisco	Eligible	No	Recreation History, Historic Archeology
Mile Rock Tunnel	San Francisco	Eligible	No	Engineering

HISTORIC PROPERTIES WITHIN THE PARK BOUNDARY (By County, Alphabetically)				
RESOURCE	COUNTY	LISTED ON NATIONAL REGISTER	NATIONAL HISTORIC LANDMARK	AREAS OF SIGNIFICANCE
Point Lobos Archeological Site	San Francisco	Yes	No	Ohlone History, Archeology
Pumping Station #2, San Francisco Fire Department Auxiliary Water Supply System	San Francisco (owned by City of San Francisco, located on park land)	Yes	No	Community Planning And Development, Engineering (Structure)
Presidio of San Francisco	San Francisco	Yes	Yes	Hispanic, Historic - Non-Aboriginal, Military, Exploration/Settlement (District), Architecture, Landscape Architecture, Historic Archeology
San Francisco Port of Embarkation	San Francisco	Yes	Yes	Military (District), Architecture
Seacoast Fortifications of San Francisco Bay	San Francisco, Marin, San Mateo	Individual properties already listed, eligible as a district	Eligible	Military (District), Architecture, Engineering, Cultural Landscape, Historic Archeology
Six-inch Rifled Gun No. 9 (Baker Beach)	San Francisco	Yes	No	Military (Object)
Dipsea Trail	Marin (part of the trail is on parkland)	Yes	No	Entertainment/Recreation (Sports) (Structure)
Forts Baker, Barry, and	Marin	Yes	No	Military (District), Architecture, Cultural

HISTORIC PROPERTIES WITHIN THE PARK BOUNDARY (By County, Alphabetically)				
RESOURCE	COUNTY	LISTED ON NATIONAL REGISTER	NATIONAL HISTORIC LANDMARK	AREAS OF SIGNIFICANCE
Cronkhite				Landscape, Historic Archeology
Hill 640 Military Reservation	Marin	Eligible	No	Military
Hillwood Camp	Marin	Eligible	No	Social History
Muir Beach Archeological Site (CA.MRN-333)	Marin	Yes	No	Coast Miwok History And Archeology
Muir Woods National Monument	Marin	Yes	No	Conservation (District), Architecture, Landscape Architecture
Olema Valley Historic District	Marin (administered by Point Reyes National Seashore)	Eligible	No	Agriculture (Dairy Ranching), Cultural Landscape
Point Bonita Historic District	Marin	Yes	No	Architecture, Maritime History, Commerce, Transportation (District)
Ranch A/B (Miwok Stables)	Marin	Eligible	No	District, Cultural Landscape, Agriculture (Dairy Ranching)
Ranch M (Golden Gate Dairy)	Marin	Eligible	No	District, Cultural Landscape, Agriculture (Dairy Ranching), Historic Archeology
Sara Seaver Randall	Marin (administered)	Eligible	No	Agriculture (Dairy

HISTORIC PROPERTIES WITHIN THE PARK BOUNDARY (By County, Alphabetically)				
RESOURCE	COUNTY	LISTED ON NATIONAL REGISTER	NATIONAL HISTORIC LANDMARK	AREAS OF SIGNIFICANCE
House	by Point Reyes National Seashore)			Ranching), Social History
Steamship Tennessee Remains	Marin	Yes	No	Invention, Transportation, Commerce, Maritime Archeology
San Francisco Bay Discovery Site	San Mateo	Yes	Yes	Exploration/Settlement

HISTORIC PROPERTIES ADJACENT TO THE PARK BOUNDARY				
RESOURCE	COUNTY	LISTED ON NATIONAL REGISTER	NATIONAL HISTORIC LANDMARK	AREAS OF SIGNIFICANCE
Aquatic Park Historic District	San Francisco (owned and managed by San Francisco Maritime National Historical Park)	Yes	Yes	Architecture, Community Planning And Development, Art, Military (District)
Point Montara Light Station	San Mateo (owned and managed by United States Coast Guard)	Yes	No	Architecture, Maritime History, Commerce, Transportation (District)
San Francisco Veterans Affairs Medical Center	San Francisco (owned and managed by Department of Veterans' Affairs)	Yes	No	Architecture, Engineering, Health/Medical (District)

**OTHER PROPERTIES WITHIN THE PARK
POTENTIALLY ELIGIBLE FOR THE NATIONAL REGISTER OF
HISTORIC PLACES**

(In Need of Determination of Eligibility)

RESOURCE	COUNTY	AREAS OF SIGNIFICANCE	MANAGEMENT JURISDICTION
China Beach	San Francisco	Architecture, Community Planning and Development, Recreation	NPS
Cliff House	San Francisco	Architecture, Recreation	NPS
Crissy Field Ohlone District	San Francisco	Ohlone History, Archeology, And Heritage	NPS
Fort Mason Ohlone District	San Francisco	Ohlone History, Archeology, And Heritage	NPS
Marine Exchange Lookout (Octagon House)	San Francisco	Architecture, Maritime History, Commerce, Transportation	NPS
Neptune Shipwreck	San Francisco	Maritime Archeology	Multiple
O'Shaughnessy Seawall (Ocean Beach)	San Francisco	Engineering, Community Planning and Development, Recreation	NPS
Ocean Terrace Site	San Francisco	Historical Archeology	NPS
Shipwrecks of the Golden Gate	San Francisco, Marin, San Mateo	Maritime Archeology	Multiple
Sutro Baths	San Francisco	History, Engineering, Historic Archeology	NPS
Sutro Heights	San Francisco	History, Cultural Landscape, Historical Archeology	NPS
Angel Island Coast Miwok Sites	Marin	Coast Miwok History, Archeology, And Heritage	State of California
Bolinas Copper Mines	Marin	Mining And Industrial History	Point Reyes National Seashore
Bolinas Lagoon Coast Miwok Sites	Marin	Coast Miwok History, Archeology, And Heritage	Multiple
Druid Heights	Marin	Social History	NPS

OTHER PROPERTIES WITHIN THE PARK POTENTIALLY ELIGIBLE FOR THE NATIONAL REGISTER OF HISTORIC PLACES (In Need of Determination of Eligibility)			
RESOURCE	COUNTY	AREAS OF SIGNIFICANCE	MANAGEMENT JURISDICTION
District			
Elk Valley Coast Miwok Site	Marin	Coast Miwok History, Archeology, And Heritage	NPS
Marin Headlands Coast Miwok Sites	Marin	Coast Miwok History, Archeology, And Heritage	Multiple
Miwok Trail	Marin	History, Recreation	Multiple
Muir Beach Coast Miwok District	Marin	Coast Miwok History, Archeology, And Heritage	NPS
Tomaes Bay and Olema Valley Coast Miwok Sites	Marin	Coast Miwok History, Archeology, And Heritage	Point Reyes National Seashore
Francisco Guerrero Adobe Site	San Mateo	Social History, Mexican California	Multiple
Martini Creek Ohlone Sites	San Mateo	Ohlone History, Archeology, And Heritage	NPS
Phleger Estate Logging Sites	San Mateo	1850s Redwood Logging History	NPS
Rancho Corral de Tierra	San Mateo	Agriculture, Cultural Landscape	NPS
Shelldance Nursery	San Mateo	Commerce	NPS

**OTHER PROPERTIES, NOT ELIGIBLE FOR THE NATIONAL REGISTER
OF HISTORIC PLACES WITH SPECIAL MANAGEMENT**

RESOURCE	COUNTY	STATUS
Sutro Heights District	San Francisco	Determined ineligible for listing on the National Register. Park manages the district and associated features as a cultural resource.

CULTURAL RESOURCES LISTED IN OR ELIGIBLE TO BE LISTED IN THE NATIONAL REGISTER OF HISTORIC PLACES

National Historic Landmarks

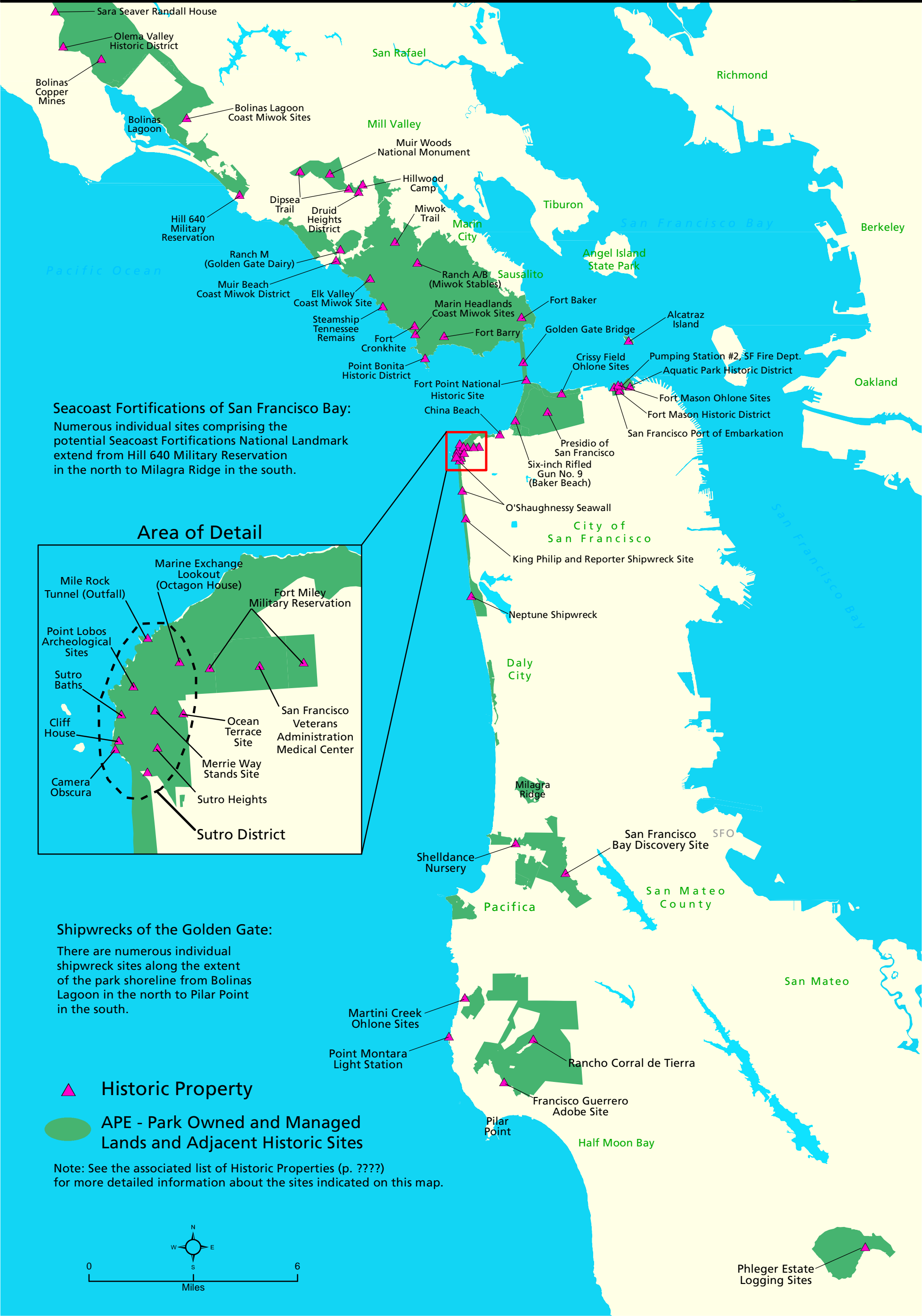
National historic landmarks are buildings, sites, districts, structures, and objects that have been determined by the Secretary of the Interior to be nationally significant in American history and culture. National historic landmarks possess exceptional value or quality in illustrating or interpreting the heritage of the United States in history, architecture, archeology, technology, and culture, and possess a high degree of integrity of location, design, setting, materials, workmanship, feeling, and association. National historic landmarks are significant because they

- are associated with events that have made a significant contribution to, and are identified with, or that outstandingly represent, the broad national patterns of United States history; or
- are associated importantly with the lives of persons nationally significant in the history of the United States; or
- represent some great idea or ideal of the American people; or
- embody the distinguishing characteristics of an architectural type specimen exceptionally valuable for the study of a period, style, or method of construction, or that represent a significant, distinctive, and exceptional entity whose components may lack individual distinction; or
- are composed of integral parts of the environment not sufficiently significant by reason of historical association or artistic merit to warrant individual recognition but collectively compose an entity of exceptional historical or artistic significance, or outstandingly commemorate or illustrate a way of life or culture; or
- have yielded or may be likely to yield information of major scientific importance by revealing new cultures, or by shedding light upon periods of occupation over large areas of the United States.

All national historic landmarks are included in the national register of Historic Places, which is the official list of the nation's historic properties worthy of preservation. National historic landmarks constitute more than 2,400 of the almost 83,000 entries in the national register; the other entries in the national register are of state and local significance. The process for listing a property in the national register is different from that for national landmark designation with different criteria and procedures. Some properties are recommended as nationally significant when they are nominated to the national register, but before they can be designated as national historic landmarks, they must be evaluated by the National Park Service's National Historic Landmark Survey, reviewed by the National Park System Advisory Board, and recommended to the Secretary of the Interior.

Area of Potential Effect Historic Properties

National Park Service
U.S. Department of the Interior
Golden Gate National Recreation Area
Muir Woods National Monument



Within the park's boundaries, the Secretary of the Interior has designated five national historic landmarks:

- Alcatraz Island
- Fort Point National Historic Site
- Presidio of San Francisco
- San Francisco Bay Discovery Site
- San Francisco Port of Embarkation

In addition, Aquatic Park Historic District, a national historic landmark managed by San Francisco Maritime National Historic Park, is adjacent to the Golden Gate National Recreation Area and could be affected by actions proposed in the general management plan. Brief descriptions of all of these properties are included here.

Alcatraz Island National Historic Landmark

Alcatraz Island includes cultural landscapes, historic structures, archeological sites, object collections, and stories associated with its use as a Civil War fort, military prison, federal penitentiary, and the site of the Indian Occupation of 1969 to 1971. Because of its strategic location in the San Francisco Bay, the island has been the site of events that have had a significant impact on the nation as a whole, from before the Civil War through the Indian Occupation. Its significance in the areas of military history, social history (penology), and maritime commerce (related to the Gold Rush and the Civil War) is enhanced by the integrity of its resources, which has resulted from the fact that access to the island has been strictly limited throughout its history.

Maritime commerce was aided by the first U.S. lighthouse on the Pacific Coast built on the island in 1854; its successor still serves. First garrisoned on December 30, 1859, the post was officially designated Alcatraz Island but was often referred to as Fort Alcatraz. By the start of the Civil War, Alcatraz was the key fort in the center of the most significant Pacific port in 19th century America. It mounted the first permanent cannon on the west coast of the United States, and featured a brick and masonry defensive barracks known as the "Citadel," which may have been unique in the annals of American military architecture. Alcatraz was designated as the official military prison for the entire Department of the Pacific on August 27, 1861, and was the first official army prison in the nation.

When Alcatraz became a civilian penitentiary in 1934, it quickly gained nationwide attention due to its association with many of the most infamous criminals of the gangster era and the bloody escape attempts made from there. It is representative of the far end of the penology spectrum, because it was a prison designed for punishment and incarceration only, not rehabilitation. It is of national importance in this regard because of its use as a repository of incorrigibles throughout the federal prison system, including Robert Stroud ("Birdman of Alcatraz"), Alphonse Capone, and George Kelly Barnes ("Machine Gun Kelly"). Alcatraz Island is certainly the best known prison in American history and arguably, along with France's "Devil's Island," is among the most infamous prisons in the world.

Alcatraz Island was occupied by "Indians of All Tribes" from November 1969 to June 1971 during an internationally publicized protest to focus attention on the plight of

American Indians and to assert the need for Indian unity and solidarity for achieving self-determination and securing political rights. Thus, the occupation increased awareness of the American Indian's political, economic, and social concerns and provided foundation for what would become a political movement—the American Indian Movement—to promote racial pride and secure and protect Indian rights. Tangible evidence of their occupancy on the island includes graffiti and physical alterations attributed to their actions.

The period of significance for Alcatraz stretches from 1847, when the island was first surveyed for military fortifications, to 1971 when the National Park Service acquired the land. This period of significance covers the military fortifications period (1847–1907), military prison period (1861–1933), federal prison period (1933–63), and American Indian occupation period (1969–71). Alcatraz Island was opened to the public as part of Golden Gate National Recreation Area in 1973, listed in the National Register of Historic Places in 1976, and designated as a National Historic Landmark in 1986.

The current landscape of Alcatraz consists of features and characteristics from each of the island's historically significant periods that are used to define cultural landscapes—buildings, structures, spatial organization, circulation, small-scale features, topography, vegetation, natural systems and features, archeological sites, and land use. It includes numerous contributing buildings and structures, and 81 areas of historic archaeological concern not yet listed in the Landmark inventory.

Fort Point National Historic Site

Fort Point National Historic Site is located within the Presidio of San Francisco, near the south anchorage of the Golden Gate Bridge. Though this landmark is within the park boundary, it is not included in the planning area. Constructed between 1853 and 1861, Fort Point is the only example of a casemated Third System fort completed on the Pacific Coast. It is also the most unaltered such fort left in the United States. Situated on the southern tip of the Golden Gate, the fort was a vital part of San Francisco's harbor defense during the Civil War, and played a role in defending the harbor entrance during World War I and World War II. Associated historic resources include Battery East, build to supplement the obsolete brick fort, the historic seawall and promenade and numerous historic landscape features and historic archeological sites.

Presidio of San Francisco National Historic Landmark

Established in 1776 by the Spanish and continued as a military post under the Mexicans and the Americans, the Presidio possesses a visual unity and a high degree of integrity that relates well to its historical importance and continuity through successive periods of development. The Presidio of San Francisco was the oldest Army installation operating in the American West and was one of the longest-garrisoned posts in the country. More than 200 years of military occupation of the Presidio have resulted in the development of a complex historic district of several overlaying historic landscapes, each composed of buildings, structures, objects, sites, and other features that represent multiple phases of development. Among the Presidio's over 450 historic buildings are examples of every major building period of U.S. military history since the 1850s. Over the years, the U.S. Army's careful site planning and extensive landscape design complemented the natural beauty of the site and made the Presidio unique among U.S. Army posts. As headquarters for the protection of the Bay and for military expeditions throughout the West, the

Presidio remained strategically the most significant military post on America's Pacific Coast during most of its extended history, until its closure in 1994. In 1994 the U.S. Army transferred the Presidio to the NPS. In 1996, the Presidio Trust Act enacted by Congress, gave jurisdiction of the inland area of the Presidio (known as Area B) to the Presidio Trust; the National Park Service continues to manage the shoreline areas, known as Area A. The Presidio is not part of the planning area covered by this general management plan.

San Francisco Bay Discovery Site National Historic Landmark

Located in the city of Pacifica, California, the site of the discovery of San Francisco Bay consists of the point at which the Portola Expedition of 1769 crossed over Sweeney Ridge and for the first time, came to view one of the world's largest sheltered anchorages. From the top of Sweeney Ridge, one can see not only inland to the Bay, but north along the ocean coast as far as Point Reyes. This landmark is on the crest of Sweeney Ridge and commemorates the place from where the main body of Spanish explorer Gaspar de Portola's expedition first sighted San Francisco Bay on November 4, 1769. The bay would become the most important harbor on the Pacific Coast of the United States and one of the great anchorages of the world. Following this discovery by the Spaniards, a presidio and two missions were established in what is now San Francisco. No structures are on the site nor are any in the immediate vicinity. It is likely that no structures ever have been there. Today, the site consists essentially of two knolls from which the member of the expedition acquired the view. The total acreage of the site is approximately 18.15. There are two commemorative monuments that celebrate the Gaspar de Portola Expedition. The view of course has changed considerably with the growth of the Bay Area, now including widespread suburban development.

San Francisco Port of Embarkation National Historic Landmark

This historic district is listed as a national historic landmark for its association with World War II in which it was defined as the principal port on the West Coast for delivering personnel, material, weapons and ammunition to the military campaigns in the Pacific Theater of War. During the months after the United States first entered World War II, the U.S. Army's San Francisco Port of Embarkation shipped more military supplies than all other military ports in the United States combined.

The statistical returns for the entire war showed that San Francisco was second only to New York in the numbers and amounts of personnel shipped to the war zones. Between December 1941 and August 1945, 1,745,000 personnel embarked at San Francisco. In addition, more than half a million veterans of the war debarked at San Francisco during the same period. An equal number came through the Golden Gate after conclusion of the hostilities. All American dead being returned to the United States from the Pacific were brought through the port. Japanese and German prisoners of war were processed through this port's facilities, as well.

During the war years, more than 25 million measurement tons of cargo were shipped through San Francisco. For various periods of time between 1941 and 1944, the ports of Los Angeles, California; Portland, Oregon; and Seattle, Washington were administered by San Francisco. In the Bay Area, Fort Mason oversaw port operations for no fewer than 13 other installations. San Francisco was the primary port for Army troops and supplies

in the central, south, and southwest Pacific areas. Moreover, the task force that drove the Japanese from Alaska's Aleutian Islands was mounted from San Francisco.

The district is significant within the area of military history for the period from 1912 to 1945. It contains 210 acres, 14 buildings, and 5 structures predominantly located at lower Fort Mason. Building 201 at upper Fort Mason, currently the park headquarters is a contributing resource to the district.

Aquatic Park Historic District National Historic Landmark

This property is outside the general management plan planning area but is adjacent to the park's Fort Mason Historic District in San Francisco. Aquatic Park Historic District is bounded by Van Ness Avenue and Hyde and Polk Streets and has an important interrelationship with Golden Gate National Recreation Area. Developed from 1936 to 1939, the park was one of California's largest Works Progress Administration projects, reflecting President Franklin D. Roosevelt's policy of providing employment to architects and artists during the Great Depression. The centerpiece of this group of "streamline moderne" structures, all employing nautical metaphors, is a multipurpose structure containing the bathhouse, concession stand, and lounge. Its rounded walls, recessed upper stories, tubular steel railings, and porthole windows were designed to create the illusion of an ocean liner. Murals and other artwork carry out the nautical theme. This main building, lifeguard stations, stadium, Sea Scout building, a seawall, and a semicircular pier form the Aquatic Park Historic District, which now is part of the San Francisco Maritime National Historical Park. The district contains ten acres of land with three buildings and five structures that are significant for the period from 1920-1945.

Potential National Historic Landmark Properties

Coastal Seacoast Fortifications of San Francisco Bay

The coastal seacoast fortifications of San Francisco Bay, which are currently being evaluated for designation as a national historic landmark, today comprise what is widely considered to be the most comprehensive collection of military architecture and coastal defense systems and the finest surviving examples of military engineering for coastal defense in the United States. The significance of the seacoast fortifications structures of the Bay Area as a group is of the highest order. These fortifications span San Mateo (Milagra Ridge, Devils Slide), San Francisco (Presidio, Fort Funston, Fort Mason, Fort Miley, Alcatraz and Fort Winfield Scott in the Presidio), and Marin (Forts Baker, Barry and Cronkhite) counties and encompass over 40 major caliber gun batteries and scores of other supporting structures. Moreover, as well-preserved examples of nearly every important development in military fortification architecture and engineering from before the Civil War to the guided missile era, they embody an extraordinary range of distinguishing characteristics of military architecture, engineering, style, and construction and outstandingly illustrate military culture and technique. They are tangible manifestations of changing periods in the nation's history and of its changing military responses, and provide associative links with people important to the history of the nation as a whole, from John C. Fremont and "Kit" Carson to Irvin McDowell and Douglas MacArthur. The military reservations that provide a relatively unchanged physical context for these fortifications also provide a spectacular scenic backdrop of largely undeveloped open space at the very edge of a great urban metropolis.

Golden Gate Bridge

The Golden Gate Bridge is on park property but is owned and managed by the Golden Gate Bridge, Highway, and Transportation District. It was determined eligible for listing on the national register in 1980 and was designated a California State Historic Landmark in 1990. The Golden Gate Bridge has not yet been listed in the national register. In 1997, the National Park Service prepared a national historic landmark nomination for the Golden Gate Bridge but it has not yet been designated as a landmark. The National Park Service was a concurring party to a Memorandum of Agreement for the Golden Gate Bridge Physical Suicide Deterrent System Project to complete and submit a landmark nomination for the Golden Gate Bridge that includes significant associated buildings, structures, roadways and pedestrian circulation features and landscaping.

Olema Valley Historic District

This rural historic landscape consists of former dairy ranches in West Marin County and, although within the authorized boundaries of Golden Gate National Recreation Area, is managed by Point Reyes National Seashore for reasons of geographic proximity.

National Register of Historic Places

The National Register of Historic Places is a list of properties (districts, sites, buildings, structures, and objects) that possess the quality of significance in American history, architecture, archeology, engineering, and culture, as well as integrity of location, design, setting, materials, workmanship, feeling, and association. Properties listed in the national register are significant because they

- are associated with events that have made a significant contribution to the broad patterns of our history; or
- are associated with the lives of persons significant in our past; or
- embody distinctive characteristics of a type, period or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded, or may be likely to yield, information important in prehistory or history.

Properties Listed in the National Register of Historic Places

Marin County

Dipsea Trail. The historic Dipsea Trail, which extends from Mill Valley to Stinson Beach, and runs through parts of Muir Woods, is one of the oldest foot races in the nation.

Forts Baker, Barry, and Cronkhite. These military fortifications and installations comprise some of the earliest coastal defense artillery batteries in Marin County and are significant landmarks for tracing the development of the American defense system. The land, on which they were constructed, strategically located at the northern point of the Golden Gate, commands the approaches to the San Francisco Bay entrance. The batteries and their ancillary structures (observation posts and cantonments) created a coordinated

system of defense at the Golden Gate from the Civil War to the Cold War. The scope of the landscape afforded by the three military fortifications includes both Native American and European-associated attributes.

In 1866, Forts Baker and Barry were acquired by purchase to be used for military defense. Fort Cronkhite was acquired in the same manner in 1914, but was considered a portion of Fort Barry until officially designated as Fort Cronkhite in 1937. The fortifications proposed for construction at the northern point of the Golden Gate were to augment those at the Presidio of San Francisco and elsewhere in San Francisco to prevent successful passage of hostile ships through the Golden Gate into the Bay. The batteries and their ancillary structures (observation posts and garrisons) created a coordinated system of defense at the Golden Gate. From the Civil War to the Cold War eras, this system of defense offered equipment ranging from smoothbore muzzle-loading cannon to rifled, breach-loading artillery, including anti-aircraft and anti-breach-landing defense from World War II and Nike anti-aircraft missiles from the Cold War. The Fort Cronkhite cantonment is not only highly representative of the once ubiquitous 700-Series World War II mobilization cantonments; it is considered the best-preserved example of its type in the nation. The district is spread over 1400 acres and over 100 historic and structures.

Muir Beach Archeological Site. This Coast Miwok archeological site dating from about AD 1300 is one of only a few such properties known in southwestern Marin County. It was recorded in 1909, and appears to be part of a series of periodic villages or encampments formed around the estuary at the mouth of Redwood Creek below present day Muir Woods between AD 1100 and as late as 1800.

Muir Woods National Monument. In 2008, Muir Woods National Monument historic district was listed on the NRHP for its significance as an early and lasting example of natural resource conservation by the federal government. In addition to the forest of giant redwood trees, the monument's collection of historic buildings, structures, and cultural landscape are representative of the National Park service's rustic design style. It is a 425-acre historic district with 5 contributing buildings, and numerous historic structures which comprise the principal elements of the cultural landscape. See the "Cultural Resources—Muir Woods National Monument" section of this document for more detailed information.

Point Bonita Historic District. The Point Bonita Historic District, located at the entrance to San Francisco Bay from the Pacific Ocean, includes both the Point Bonita Light Station and the Point Bonita Life-Saving Station and associated landscape features. Established in 1855 to mark the entrance to San Francisco Bay and to warn of local navigational hazards, the district is linked to the historic growth of commercial shipping along the West Coast and to California's critical reliance on maritime transportation and the aids that made navigation possible. The light station contains an intact lighthouse tower with an intact lens and an associated fog signal building. The tower and fog signal building, clustered together at the end of the rocky point, retain a high degree of integrity and give cohesiveness to the light station site. This is heightened by the buildings' separation from the main access path by a pedestrian suspension bridge; Point Bonita is the only lighthouse in the United States approached by a suspension bridge. The light station retains the general form of a formal late 19th – early 20th century light complex.

Steamship Tennessee Remains. The SS *Tennessee*, a side-wheel commercial passenger-cargo steamer, owned by the Pacific Mail Steamship Company and destined for Panama, crashed against the rocks in Indian (Tennessee) Cove, some three miles north of Point Bonita on March 6, 1853, amid dense fog and high surf. Today the Tennessee Valley Trail leads visitors to the cove where the ship's remains are occasionally uncovered by the restless surf.

San Francisco County

Camera Obscura. The Camera Obscura was added to the National Register of Historic Places in 2001 on the basis of the engineering significance of the camera mechanism—the largest camera obscura remaining in situ in the nation. The exterior of the building was extensively modified in 1957 to appear as a giant camera, and may be reevaluated for historical significance upon reaching fifty years of age.

Fort Mason Historic District. Beginning in 1797 and lasting through the Spanish and Mexican administrations of Alta California, Fort Mason (including Batteria San José, Punta Medanos, Battery Yerba Buena, Point San José, Black Point, and the Post of Point San José) was one of two sites in San Francisco Bay that was armed with artillery for the defense of the harbor. For over 40 years of American administration, from the Civil War to the post-Spanish American War era, Fort Mason played a role in the coastal defenses of the Bay. It also served as an important element in the first submarine mining of San Francisco Bay during the Spanish American War. From the Spanish American War to the Korean War, Fort Mason was the headquarters of the San Francisco Port of Embarkation.

Fort Mason contains a collection of military structures dating from the 1850s to the Korean Conflict that illustrates the evolution of an army post and seacoast fortifications over a period of some 100 years. The variety and contrasts among many styles of the architecture, the effect of the Army's caste system on the quarters, the charm of the earliest officers' row, the simple lines of the Endicott battery, the Works Progress Administration architecture of the Great Depression, and the Army's determination in landscaping all blend together to present a history of this place and its times. The district includes 146 historic buildings and structures spread over 68 acres of land. A wooden pier (Pier 4) and small buildings at its terminus are associated with prison operations on Alcatraz Island. The historic landscape is also a contributing feature of the district. Five archeological sites associated with Ohlone native peoples and other historic archeological sites are located at Fort Mason; however, they listed in a separately-themed historic district nomination.

Fort Miley Military Reservation. This historic district is a military landscape comprised of battery emplacements, fire control stations, and searchlight facilities that served as part of the defense system for the strategic harbor of San Francisco. These features of East and West Fort Miley were part of the defense system for the strategic harbor of San Francisco, long regarded by Army engineers and strategists as the most important harbor on the west coast of the United States. The fortification of Point Lobos in 1899 marked the final phase of the Endicott system of seacoast defense, when it was determined that the guns and mortars should be placed as far toward the sea as possible and that the inner harbor defense represented by the early Endicott-type batteries was of less importance.

The guns of Fort Miley, together with those of Fort Barry on the northern side of the Golden Gate, became San Francisco Bay's important "outer line of defense" at the turn of

the last century. The massive concrete and earth batteries, Chester and Livingston, represented the latest in design and engineering of the Endicott works as of 1900. Later installations at Fort Miley, such as a coastal searchlight powerhouse and fire control stations for other and later batteries, mark further advances in the theory, practice, and technology of seacoast defenses.

Fort Miley's continuing importance in the harbor defenses of San Francisco is illustrated by construction of a 6-inch gun battery during World War II and the subsequent arming of this battery as late as 1948—the last of the coastal guns to be mounted in the San Francisco Bay Area.

King Philip / Reporter Shipwreck Site. The *King Philip*, a three-masted wooden clipper ship named for the Indian chief who was involved in King Philip's War in 1675, crashed on Ocean Beach amid heavy surf on January 25, 1878, after leaving San Francisco without cargo. First launched in 1856, the ship went into the lumber trade working for Pope and Talbot of San Francisco after its glory days as a clipper. The location, and the remains, has also been associated with the 1876 three-masted schooner "Reporter", which wrecked in the same location March 13, 1902. The remains appear whenever storm surf scours the beach sands low enough to expose the hull.

Point Lobos Archeological Sites. The Point Lobos sites include two prehistoric Ohlone archeological sites dating from about AD 300–1100. These sites are encampments in the dunes of western San Francisco that evidence harvesting of sea mammals and shellfish from the nearby ocean shoreline. They are among a handful of prehistoric sites left in San Francisco.

Pumping Station #2, San Francisco Fire Department Auxiliary Water Supply System. Pumping Station #2 of the San Francisco Fire Department Auxiliary Water Supply System represents an example of an innovatively planned and designed "earthquake proof" fire fighting system for San Francisco. The pumping station is significant within the areas of community planning and engineering for the City of San Francisco. Its period of significance is 1912 to 1975. Although the building is sited on park land in the Fort Mason Historic District, the facility is still owned and utilized today by the City of San Francisco.

Six-inch Gun No. 9 (Baker Beach). The Six-inch Gun Number 9 and disappearing carriage were received by the National Park Service in 1977 from the Smithsonian Institution. The gun and carriage were installed at gun emplacement Number Four at Battery Chamberlin, located in the Presidio of San Francisco, and are the same type originally used there. Battery Chamberlin is an Endicott-era battery completed and armed in 1904 with four six-inch guns mounted on disappearing carriages. The battery was built to protect underwater minefields laid outside the Golden Gate during the time of war. The original guns were dismounted in 1917 for use in World War I, but the battery was modified to receive two six-inch guns on simple barbette carriages in 1920. During World War II, the Sixth Coast Artillery (Harbor Defense) Regiment, Battery "D," manned the two guns at Battery Chamberlin, which were placed under camouflage netting to hide them from potential air attack. In 1948, the Coast Artillery Corps was deactivated, the battery disarmed, and the guns scrapped. Today, an underground magazine contains photos and small exhibits on the harbor defenses of San Francisco. Operation of the gun and the magazine are open to the public periodically.

In addition to these properties which are within the park boundaries, there are two additional properties within the area of potential effects that are adjacent to the park boundary and could be affected through actions proposed in this plan. These are

Point Montara Light Station. Point Montara Light Station District covers 73 acres containing three contributing buildings and one contributing structure. The Light Station was established in 1875 as the Point Montara Fog Signal, and the house was built for the keepers. The first light was not installed until 1900, a simple lantern hung on a post. In 1912, a Fresnel lens was mounted on a skeleton tower, and in 1928, the existing cast-iron lighthouse was built to house the lens. The old-fashioned fog horn continued to be important because the fog on this part of the coast is often thick enough to restrict even the bravest beam. The property is owned and managed by the United States Coast Guard, but will likely be added to the park in the near future.

San Francisco Veterans Affairs Medical Center. This property occupies a 29-acre campus in the northwest corner of San Francisco, of which the historic district is approximately 12 acres. It is surrounded on three sides by Fort Miley. It is owned and managed by the Department of Veterans' Affairs.

Properties Determined to be Eligible for Listing in the National Register of Historic Places

Several properties within the park boundary have been identified, evaluated and assessed for their eligibility for listing on the National Register of Historic Places. The term eligible for inclusion in the national register refers to properties formally determined as such in accordance with regulations of the Secretary of the Interior and to all other properties that meet the national register criteria without a formal determination. For purposes of park management and planning, these properties are treated as contributing resources.

Marin County

Sara Seaver Randall House. Habitation of one of the earliest Anglo settlers in Marin County. The property is managed by Point Reyes National Seashore.

Hill 640 Military Reservation. This reservation, including the cultural landscape as well as the remains of its radar set and fire control stations are prime examples of the methods that evolved for the better direction of coast artillery fire against enemy vessels at sea. Overlooking the Pacific Ocean and the southern end of Stinson Beach, they are the best surviving representatives of the most northerly complexes of fire control installations for the defense of San Francisco Bay during the critical years of World War II. The radar, a surface detector set, was the first of its type assigned to the San Francisco Harbor defenses. These features are little disturbed from World War II and retain very high integrity.

Ranch M (Golden Gate Dairy). The Golden Gate Dairy at the lower end Redwood Creek is one of the last agricultural operations remaining with historic integrity intact. It was originally one of dozens of Portuguese-owned dairies in southern Marin County. The main house was built circa 1898–1900 by Azorean immigrant M. A. Mattos. The Lopez family operated a Grade A dairy here from approximately 1943 to 1962. The site contains several residences, corrals, utilitarian structures, fence lines, pastures, windbreaks, and

historic archeological deposits. The cultural landscape of the Golden Gate Dairy includes residences, corrals, utilitarian structures, fence lines, pastures, and windbreaks.

Ranch A/B (Miwok Stables). The Rapozo Ranch in the Tennessee Valley of the Marin Headlands, currently operated as the Miwok Ranch or Stables, is one of the last agricultural operations remaining with intact historic integrity. It was originally one of dozens of Portuguese-owned dairies in southern Marin County. The main house was probably built circa 1903 by Azorean immigrant M. F. DaCunha, the first single owner of the ranch. The ranch was used by the Rapozo family from 1945 to the present. The site contains a hay barn, riding barn, sanitary (dairy) barn, two residences, corrals, a eucalyptus windbreak, and other ranching features.

Hillwood Camp. The earliest surviving example in Marin County of a rural camp reflective of an effort to immerse urban-dwelling youth in a natural environment. The property includes the main lodge and associated features.

Olema Valley Historic District. Collection of properties along State Route 1, north of Bolinas representing a cultural landscape of rural farming from the late-19th and early-20th century period. The district is managed by Point Reyes National Seashore.

San Francisco County

Merrie Way Stands Site. An historic archeological site associated with an early San Francisco amusement park established by Adolph Sutro at Land's End in 1895. The pleasure ground and its concession stands lining Lobos Avenue existed until about 1920, when the last of the amusement structures were demolished.

Mile Rock Tunnel. Completed in 1915, the tunnel is an example of the reconstruction and reconfiguration of the City of San Francisco's public works system following the 1906 earthquake. Designed by M. M. O'Shaughnessy, a San Francisco City Engineer best known for his design of the Hetch Hetchy Water System, the tunnel was the first constructed in the city using a combination of open cut timber cribbing and boring through solid rock, a technological and engineering innovation for the city. It served as the storm drainage facility for the Sunset and West Mission districts and portions of the Richmond and Ingleside districts.

Properties Potentially Eligible for Listing in the National Register of Historic Places

Potentially eligible properties include those that have been identified by park staff and other cultural resource professionals as being potentially eligible for listing in the national register. These properties need to be further assessed and evaluated in order to make a determination of eligibility in the near future. A determination of eligibility would be made in advance of activity or work that could directly affect them.

Marin County

Bolinas Copper Mine. The scenic Wilkins Ranch, at the head of Bolinas Lagoon, witnessed three waves of mining fever on the upper slopes of Bolinas Ridge, beginning in the 1860s. The Chetco Mining Company, more successful than its predecessors, closed its doors in 1918; it was the last operation to work the vein. Cultural landscape features include the mine's adit and shaft, a mining road, concrete foundations and cabin site, a

rusty boiler and cable, and other large debris. The property is managed by Point Reyes National Seashore.

Bolinas Lagoon Coast Miwok Sites. A series of four pre-contact archeological sites which contain significant information on Coast Miwok history in southwestern Marin.

Druid Heights. Potentially significant as the site of a colony of artists, writers, Zen philosophers (Alan Watts) influential in the development of the counter-culture of the 1960s.

Marin Headlands Coast Miwok Sites. A series of three pre-contact archeological sites which contain significant information on Coast Miwok history near Rodeo Lagoon in Fort Barry and Fort Cronkhite.

Miwok Trail. Potentially significant as one of the earliest trails in the region.

Muir Beach Coast Miwok Sites. A district of three pre-contact archeological sites, including the National Register Muir Beach Archeological Site, which encompass the Big Lagoon area of the mouth of Redwood Creek.

San Francisco County

China Beach. Potentially significant for its architecture and design as an early post-World War II civic recreational complex.

Crissy Field Ohlone Sites. A district of two pre-contact archeological sites along Crissy Field in the Presidio of San Francisco.

Fort Mason Ohlone Sites. A district of six pre-contact archeological sites in Fort Mason, constituting the densest archeological site cluster remaining in the City of San Francisco.

Marine Exchange Lookout Station (Octagon House). Potentially significant in maritime history and commerce as well as for its rare and unusual style of architecture.

O'Shaughnessy Seawall. Potentially significant in the fields of engineering, city planning and recreation as part of the long recreational history of Ocean Beach.

Ocean Terrace Site. An historic archeological site of a commercial district associated with Adolph Sutro's Lands End properties.

Sutro Baths. Archeological remains of a major public natatorium constructed by Adolph Sutro in the 1890s and lasting until its destruction by fire in 1966. The site is a significant historic landmark in San Francisco and maintains key engineering features that facilitated its operation.

Neptune Shipwreck. Remains of the shipwreck of the 1882-constructed schooner SS Neptune, which wrecked on Ocean Beach near Fort Funston in 1900. Exposed by winter scour of beach sands in 1983.

San Mateo County

Phleger Estate. The Phleger Estate cultural landscape contains historic archeological sites relating to the area's logging history such as numerous skid roads, camps, and mill sites, as well as potential Ohlone archeological sites.

Rancho Corral de Tierra. The cultural landscape of Rancho Corral de Tierra may include structures, landscape features, and archeological sites associated with historic

ranching operations dating back as far as the Mexican rancho era. These could include the site of the historically-documented 1840s adobe residence of Francisco Guerrero y Palomares, original grantee of the northern part of Rancho Corral de Tierra; and the Martini Creek Ohlone Sites: a district of pre-contact Ohlone sites north of Montara

Shelldance Nursery. Potentially significant as representative of the cut-flower industry in west San Mateo county.

Properties Ineligible for Listing in the National Register of Historic Places with Special Management

The state historic preservation office determined the Sutro Heights District, located at Point Lobos in San Francisco, to be ineligible for listing on the NRHP in 1979 and again in 2000, although the recently restored Cliff House and the remains of the water pumping system may be reassessed for eligibility as further information is developed. The district is approximately 78 acres and includes the Cliff House, Sutro Heights, and Sutro Baths ruins. The park has chosen to manage the district and associated features, including the historic designed landscape, as a cultural resource.

ARCHEOLOGICAL RESOURCES

Definition

Archeological resources are the physical evidence of past human activity, including evidence of the effects of that activity on the environment. Information revealed through the study of archeological resources is critical to understanding and interpreting prehistory and history. Although archeological and ethnographic resources (which are covered in the following section) are considered as separate cultural resource types by the National Park Service, the two are closely interrelated.

Currently, less than 10% of Golden Gate National Recreation Area has been surveyed for pre-contact and historic archeological resources. To date, approximately 370 archeological sites have been inventoried, but the significance of those sites requires further study and evaluation. Furthermore, comprehensive consultations with Coast Miwok and Ohlone tribes and descendants regarding archeological sites with ethnographic significance in the park will continue into the future. As a result of this need for additional survey, assessment, and consultation, archeological resources in the park are subject to deterioration from natural erosion processes, inadvertent but deleterious visitor, park management, or partner activities, vandalism, and looting.

On Alcatraz Island, some 81 areas of historic archeological interest have been identified through documentary research, including substantial buried resources worthy of consideration for future incorporation into the visitor experiences on the island. There is a clear need for a comprehensive archeological survey and evaluation of the island to incorporate contributing archeological properties and issues into both the National Historic Landmark documentation and the park's future planning. Consultation with American Indian tribes regarding ethnographic significance is also needed.

Resources

Currently, there are more than 370 inventoried archeological sites in the park. Continuing research and expanding knowledge of the park's resources has resulted in a logical increase in known and expected archeological sites. Amendments to existing National Historic Landmark and National Register property documentation with this new information has lagged. Archeological sites and related historic property types in the park and monument are associated with the following themes or topics:

- Pre-contact Period (Prior to contact between indigenous and European peoples)
- Historic/Spanish, Mexican, and American Periods
- Military Reservations/Installations
- Seacoast Fortifications
- Ranching/Agriculture
- Logging
- Lighthouse/Life Saving Reservations
- Shipwrecks and Associated Remains
- Recreational Development

ETHNOGRAPHIC RESOURCES

Definitions

Ethnographic resources include sites, structures, objects, landscapes, or natural resource features assigned traditional and contemporary legendary, religious, subsistence, or other significance in the cultural system of a group associated with them.

Traditional cultural properties are ethnographic resources eligible for listing in the National Register of Historic Places. Traditional cultural properties are associated with cultural practices, beliefs, the sense of purpose, or existence of a living community that is rooted in that community's history or is important in maintaining its cultural identity and development as an ethnically distinctive people.

Currently, there are no identified ethnographic resources within the boundaries of Golden Gate National Recreation Area, although Alcatraz Island has very important ethnographic significance for American Indians, and every Coast Miwok or Ohlone pre-contact site has significant heritage values to park-affiliated native people.

History

Native Americans have called the San Francisco Bay region home for more than 10,000 years, and the park still contains archeological sites and landscapes influenced by native land management and activities. Park areas south of the Golden Gate, from the San Francisco Peninsula to the East Bay and south to Monterey, are the aboriginal lands of the Ohlones (also called Costanoans). Park lands north of the Golden Gate, primarily in Marin County and southern Sonoma County, are the aboriginal lands of the Coast Miwoks.

Both the Ohlone and Coast Miwok peoples were organized into small, politically independent societal groups or tribes; the Ohlones had about 50 tribes and the Coast Miwoks had approximately 14 tribes. Ethnohistory suggests that small villages were maintained along the marshlands. In San Francisco, villages were located in the park at present-day Fort Mason, Crissy Field, and Point Lobos. In Marin County, the Coast Miwok encampments were located in the Rodeo and Tennessee Valleys and along Redwood Creek, and at Bolinas Lagoon. Groups moved annually between temporary and permanent village sites in a seasonal round of hunting, fishing, and gathering. Periodic burning of the landscape was conducted to promote the growth of native grasses for seed gathering and to create forage for deer and elk. The worldview and spirituality of both the Ohlones and Coast Miwoks were expressed in a complex woven tapestry of stories, myth, song, dance, and ritual.

In 1776, when Spanish military and civilian settlers arrived in the San Francisco Bay area to establish military garrisons (presidios), Franciscan missions, and civilian settlements (pueblos), life abruptly and dramatically changed for the region's native peoples. With Spanish colonization came the introduction of new diseases and the establishment of mission communities meant to supplant the existing tribal organization.

Because they lived close to the Presidio's military garrison, members of the Ohlone tribes that inhabited the San Francisco Peninsula, called the Yelamu, were baptized and taken into the missions as early as the 1770s and 1780s. Because the Coast Miwok tribes lived further north, their indoctrination occurred somewhat later. In 1783, several members of the *Huimen* community, who inhabited the southernmost part of Marin County, were the first of the Coast Miwok to leave their homeland for Mission San Francisco. By 1810, introduced ideas, forced labor, and efforts to indoctrinate the indigenous peoples into an alien society and religion led to the destruction of the way of life of the Ohlones and Coast Miwoks.

Today, descendants of Ohlone and Coast Miwok peoples live throughout the San Francisco Bay area. Ohlones are organized into eight tribal bands, none of which are federally recognized, although several are seeking recognition. While participating in contemporary society, they are actively involved in the preservation and revitalization of their native culture. Restoration of native language, protection of ancestral sites, practice of traditional plant uses, story-telling, dance, song, and basket weaving are all aspects of these restoration efforts. The National Park Service works with Ohlones in stewarding the preservation and interpretation of ancestral sites and landscapes in the Presidio and throughout the park south of the Golden Gate. Additionally, the National Park Service has a government-to-government relationship with the Coast Miwoks who today form a single, federally recognized tribe, the Federated Indians of Graton Rancheria, whose recognized status was restored by congressional legislation in 2000. If and when any of the Ohlone tribes receive federal recognition, the nature of the park's relationship with these tribes will become government-to-government.

Sites

Native peoples were severed from their homelands in the park for two centuries due to European and American colonialism, irreparably rupturing their traditional connections to place; this magnifies the significance of indigenous archeological sites as focal points of native heritage today.

Archeological sites related to indigenous peoples, such as the Point Lobos Archeological Sites, the Muir Beach Archeological Site, and sites at or near Tomales Bay, Olema Valley, Bolinas Lagoon, Redwood Creek, Tennessee Valley, Rodeo Lagoon, Angel Island, Fort Mason, Land's End, Crissy Field, Mori Point, Montara, and Phleger Estate, constitute the most tangible connection between Coast Miwok and Ohlone peoples and park lands and provide a basis for understanding the history of their life ways and cultures.

Collaboration

In the late 1990s—in equal measures due to evolving NPS policy and to the rekindling of California Indian tribal life—the National Park Service made its first efforts to reach out and work with the Coast Miwok and Ohlone communities. Since the late 1990s, the National Park Service has worked on a consistent basis with the Federated Indians of Graton Rancheria (the federally recognized tribe comprised of park-associated Coast Miwoks and Southern Pomos), with the many Ohlone tribes seeking federal recognition, and with Ohlone individuals who partake in the stewardship of Ohlone heritage. Cooperative work has encompassed a broad range of park activities such as consultation on the identification, inventory, and treatment of cultural resources; collaboration on the interpretation of native history, genealogy, and culture; development of Indian-led educational programs; teacher training for Native American curricula; permanent and temporary exhibits on native history and culture; annual commemorative festivals with native components; and the permitting of religious activities on park lands and gathering of natural materials for use in traditional crafts. Recent natural resource restoration projects involving the identification and preservation of archeological sites related to indigenous peoples (i.e., the Crissy Field tidal marsh and planned Big Lagoon restoration projects) have inspired an interest in exploring the re-creation of ethnographic landscapes as a value-added component of natural resource restoration

Alcatraz Island

Although there are no identified ethnographic resources in Golden Gate National Recreation Area, Alcatraz Island has very important historical significance to American Indians. After Alcatraz became part of Golden Gate National Recreation Area, each November the International Tribal Council conducted an annual “*Unthanksgiving*” sunrise ceremony on the island. The island was occupied by “Indians of All Tribes” from November 1969 to June 1971 as an internationally publicized protest to focus attention on the plight of American Indians and to assert the need for Indian unity and solidarity for achieving self-determination and securing political rights. Thus, the occupation increased awareness of the American Indian’s political, economic, and social concerns and provided foundation for what would become a political movement—the American Indian Movement—to promote cultural pride and secure and protect Indian rights. The occupation resulted in the nation’s increased awareness of American Indian concerns and issues and the establishment of D-Q University at Davis, California, as well as other institutions throughout the nation. Commemorations were held on the island to remember the 20th and 30th anniversaries of the Indian Occupation. Tangible evidence of the occupation on the island includes painted political slogans and symbols on the buildings and physical alterations attributed to the Indians’ activities. Since the occupation, the

island has become a symbolic focal point of American Indian pride and solidarity among relocated American Indians in the San Francisco Bay area as well as the nation at large. Thus, the National Park Service recognizes the ethnographic significance of Alcatraz Island for American Indians and the island's potential for listing in the national register as a traditional cultural property.

PARK COLLECTIONS

Definition

Park collections are prehistoric and historic objects, artifacts, works of art, archival documents, and natural history specimens valuable for the information they provide about processes, events, and interactions among people and the environment.

Resources

U.S. Military history, from 1846 to the 1990s, is one of Golden Gate National Recreation Area's major themes. Much of the park land is comprised of former military fortifications and installations. The park's collections and its cultural and natural resource holdings are inextricably bound. The two largest collection types in the park are archives and archeology. The park has a park collection of more than 4.2 million objects, including archeological and historical objects and archives, oral histories, maps, and historic documents and records, which are directly associated with the wealth of historic properties in the park. Of particular importance are the documents, maps, and engineering drawings relating to the layout, construction, development, and operation of the park's military sites and installations as well as its fortifications.

The park's collections consist of the following components:

- Archival collections (3.8 million) include subjects related to lands governed by the park covering the span of history from the mid-19th century through the present, and include all media types, such as architectural drawings, maps, photographs, documents, books, and oral history recordings. Representative topics include Alcatraz and penal history in the Bay Area; Sutro Baths, Sutro Heights and Cliff House properties and history; military fortifications from the early 19th century forward; U.S. Army infantry, cavalry and coastal artillery on the Presidio of San Francisco and at multiple other sites around the mouth of San Francisco Bay; Pacific Theatre of military operations originating in the San Francisco Bay Area; military life in the 19th and 20th centuries; historic structures and cultural landscapes; farming and ranching in the Marin Headlands; and Muir Woods and the early conservation movement. Archival collections support ongoing park management as well as diverse uses by both staff and the public.
- History collections (19,757) include such things as original FBI evidence from the 1962 Alcatraz escape, original uniforms, accoutrements, and everyday objects from the U.S. Army, swimsuits and advertising materials from Sutro Baths, architectural features from historic structures, Nike Missile Site collections, and California related materials from the former Presidio Army Museum.

- Archeological collections (378,901) include formally and informally recovered prehistoric and historic artifacts derived from park lands and from specific sites listed in the NPS Archeological Sites Management Information System. These historic properties include two National Historic Landmarks (Presidio of San Francisco and Alcatraz Island), as well as many sites listed in or eligible for listing in the National Register of Historic Places.
- The natural history collection (2,030) includes a small herbarium, insect collection, and invertebrate specimens. The park's active Inventory and Monitoring program documents significant and endangered or threatened species collected from scientific research as well as paleontological specimens. While the park only maintains a small collection, other Golden Gate National Recreation Area natural history specimens are maintained in other repositories in California and New York State. The purpose of natural history collections is to support scientific research, resource management, and education; provide baseline data of park resources; and document changes that these resources are undergoing because of internal park conditions and external effects. These collections preserve locally significant species collected in response to specific research or interpretation needs, and guarantee the protection of important specimens whose preservation cannot be assured. The natural history collection is divided into three disciplines: biology, geology, and paleontology.

Golden Gate National Recreation Area houses its park collections in 15 separate facilities throughout the park that function as visitor centers, interpretive exhibits, or dedicated storage areas. Of the four largest storage repositories, two are located in buildings owned by the Presidio Trust with no lease agreements in place. The lack of a lease places park collections in a vulnerable position due to potential eviction, and deteriorating structural conditions. There is a historic tie between the park's collection and that of San Francisco Maritime National Historical Park, which was part of the park until 1988. The themes and resources of the two parks are inextricably tied together. Under an agreement between the two parks, San Francisco Maritime National Historical Park continues to house and provide limited management of most of the non-Presidio materials in Building E of Lower Fort Mason, which is part of Golden Gate National Recreation Area.

The current conditions for park collections in the park do not meet NPS standards for the long-term preservation, protection, and use of park collections. Staffing for the park collections has never been stable, thus precluding realistic access for researchers, the general public, and park staff. Although planning has been underway for some 15 years, a suitable location for the park's park collections has yet to be finally determined.

CULTURAL RESOURCES – MUIR WOODS NATIONAL MONUMENT

INTRODUCTION

Muir Woods National Monument remains an enduring and renowned example of natural resource conservation in the United States. The redwood forest, long recognized for its significance as a natural resource, is also historically significant—along with its overlay of cultural resources—for its association with the history of the American conservation movement, early conservation efforts in the Bay Area, and the legacy of rustic design in the National Park Service.

Muir Woods National Monument is nationally significant as an early and lasting example of natural resource conservation by the federal government. The monument was designated on January 9, 1908, by President Theodore Roosevelt, who acted in large part on the advice and support of Gifford Pinchot, Chief of the United States Forest Service. The creation of Muir Woods National Monument occurred at the beginning of the federal government's proactive role in conservation and preservation of natural and historic resources. Muir Woods National Monument was the tenth monument designated under the Antiquities Act of 1906, and the first designated through donation of private land—a gift from William and Elizabeth Thacher Kent. The proclamation of Muir Woods as a national monument helped spur conservation efforts elsewhere, notably protection of resources not under federal ownership. During the four decades following its establishment, Muir Woods National Monument—the first national monument located in close proximity to a major city—gained national and international renown as a place that expressed the ideals of American conservation. This perception culminated historically in a ceremony held on May 19, 1945, by the United Nations Conference on International Organization in memory of President Franklin D. Roosevelt. During the service in Cathedral Grove, speakers often referred to the spiritual quality of the site, thus attesting to the power of Muir Woods to function as a transcendent sacred space.

Muir Woods is also significant in the area of conservation for its association with early conservation achievements in the San Francisco Bay Area. It was the first public park established in an extensive conservation district that today extends along much of the western Marin Peninsula, directly across the Golden Gate from the City of San Francisco. This area is administered at the federal, state, and local levels by Golden Gate National Recreation Area, Mount Tamalpais State Park, Marin Municipal Water District, and Marin County Open Space District, an administrative structure that traces its origins back to the management structure William Kent established for Muir Woods and the adjoining lands under his ownership.

NATIONAL REGISTER OF HISTORIC PLACES

In 2008, a 425-acre Muir Woods National Monument Historic District was listed in the National Register of Historic Places. The historic district includes the 295 acres within the original national monument boundaries and additions of some 130 acres before 1940.

The district's historic buildings and structures were built during the first 32 years of Muir Woods National Monument's existence. In addition to the national monument's primary significance in the area of conservation, its buildings and major structures are also significant in the area of architecture. Dating from 1922 to 1940, the structures are representative examples of pre-World War II vernacular rustic architectural and engineering design in the National Park Service. The buildings were designed by well-known NPS architects and landscape architects and built in part through New Deal-era federal work-relief programs including the Civilian Conservation Corps. They reflect the systemwide effort that advocated a high degree of craftsmanship and the use of native materials to help harmonize built features with the national monument's forested natural landscape.

The most visible building, the Administration-Concession Building (1940) constructed through federal work relief programs, remains the focal point of the entry area, and retains overall massing and details that reflect the early development of the Park Service Modern style that became popular in the national park system after World War II. To the rear of the Administration-Concession Building is the Utility Area, which retains an intact collection of historic buildings, including the Superintendent's Residence (1922 with 1930s additions), Garage (1931), and Equipment Shed (1934) that reflects the NPS rustic style with exposed timber framing details that were consistently employed on all monument buildings up until the late 1930s.

Historic structures, which comprise the principal elements of the cultural landscape in the historic district, include trails, bridges, roads, erosion-control structures, walls and stairs, and monuments. The cultural landscape of Muir Woods National Monument historically illustrated characteristics of the National Park Service's rustic style through design of buildings, naturalistic design of trails and roads, use of natural stone for Redwood Creek revetments, and a pervasive log motif applied to footbridges, signs, gates, benches, and drinking fountains. Within the boundaries of the Muir Woods National Monument Historic District is the heart of the old-growth redwood forest. This area includes the Cathedral Grove and Bohemian Grove; main buildings and structures in the administrative and utility area which remain from the historic period; main trails and roads and their associated landscape structures that fan out from this headquarters to the northwest and south; and four monuments, one each to Ralph Waldo Emerson, Gifford Pinchot, Franklin D. Roosevelt, and William Kent.

The heart of the redwood forest on the canyon floor along the main trail retains much of the character it had during the latter part of the historic period. The forest retains its overall spatial organization formed by a corridor along the Redwood Creek and main trail, with secondary corridors along the side trails. Central focal points and nodal spaces within the forest remain Cathedral Grove and Bohemian Grove, with secondary nodal spaces at the entrance area/Administration-Concession Building and the utility area, all retaining much of their historic character.

The trail system is composed of the main trail (pre-1883) and its extension, Camp Alice Eastwood Trail (circa 1906); Ben Johnson Trail (circa 1904); Bohemian Grove Trail (circa 1905–07); Dipsea Trail (pre-1883); Fern Creek Trail (pre-1883); Hillside Trail (1908); and Ocean View Trail (1908). The Dipsea Trail, which extends from Mill Valley to Stinson Beach and runs through parts of Muir Woods, is the site of one of the oldest foot races in the nation. It was listed in the national register in 2010.

The main trail retains three bridges dating from the trails improvement by the Civilian Conservation Corps in 1934: most notably the Fern Creek Bridge, a stone-faced concrete-arch vehicular bridge, and two small wood stringer bridges over minor tributaries. There are also two log bridges remaining on the Ben Johnson Trail, probably built by the Civilian Conservation Corps between 1933 and 1937. With the exception of the three previously noted, most of the bridges on the canyon floor across Redwood Creek have been removed or replaced since 1947.

Roads in the historic district include a portion of the Dipsea Fire Road (Civilian Conservation Corps 1934–35) and the service drive, originally built in 1892 by the Bohemian Club as Sequoia Valley Road and realigned in circa 1906. Between 1934 and 1938, the Civilian Conservation Corps constructed an extensive system of stone revetments along Redwood Creek, portions of which have collapsed or been removed. Additionally, a log dam (1932) was constructed near the Emerson monument. Historically significant monuments to Ralph Waldo Emerson (1903), Gifford Pinchot (1910), William Kent (1929), and Franklin D. Roosevelt (1947) retain their integrity.

Legislation to acquire the Camp Monte Vista Tract south of the monument's main entrance was approved in 1972. Intended to support park operations relocated from within the redwood forest, it contains Hillwood Camp and Druid Heights. Hillwood is the earliest surviving example in Marin County of a rural camp reflective of an effort to immerse urban-dwelling youth in a natural environment. The property includes the main lodge and associated features and is eligible for listing in the national register. Druid Heights is potentially eligible for listing on the National Register as the site of a colony of artists, writers, and Zen philosophers (Alan Watts) influential in the development of the counter-culture of the 1960s.

ARCHEOLOGICAL RESOURCES

Although archeological sites were not comprehensively inventoried or evaluated as part of the study to nominate the Muir Woods National Monument Historic District to the National Register of Historic Places, eight historic archeological sites have been identified in the historic district; all are associated with vestiges of early uses of the monument. Additionally, numerous precontact artifacts have been identified in the national monument suggesting pre-monument native occupation. A comprehensive archeological survey of the national monument and adjoining related lands is warranted to determine if there are resources of both precontact and historic significance. An archeological survey could provide information on issues not presently well documented, such as the area's use by Native Americans; the exact locations of early buildings, structures, and landscape features that have been removed; the limits and use of the picnic areas; and construction and alignment of roads and trails.

ETHNOGRAPHIC RESOURCES

The National Park Service has not identified any ethnographic resources or traditional cultural properties within the national monument. However, an ethnographic survey and assessment needs to be conducted.

PARK COLLECTIONS

The park collections of Muir Woods National Monument are incorporated into the collections of Golden Gate National Recreation Area, and are discussed in that section of this document.

VISITOR USE AND EXPERIENCE—GOLDEN GATE NATIONAL RECREATION AREA

“These are the places I go when...urban life becomes too stressful. To be able to walk in these beautiful places; to watch the birds, hang gliders, surfers, children at play, and fishermen is a balm to the soul.” – Golden Gate National Recreation Area visitor during public scoping

Golden Gate National Recreation Area lands, which stand in sharp contrast to the nearby metropolitan areas, span three Bay Area counties and afford visitors outstanding recreational opportunities. Residents and visitors alike value the “wilderness next door,” an appropriate description for the park lands and waters that abut the highly developed areas of Marin, San Francisco, and San Mateo counties. Astounding scenic views, diverse recreational opportunities, and educational experiences coexist within Golden Gate National Recreation Area, making it a place for all ages.

DIVERSITY OF RECREATIONAL OPPORTUNITIES AND NATIONAL PARK EXPERIENCES

The wide-open spaces preserved here are a dramatic contrast to the surrounding city environment. Visitors to the park have expressed enjoyment in the open space and clean air; quiet and solitude; and the ability to commune with nature, slow down, and relax. Activities such as walking along a quiet beach, discovering a deserted coastal fortification, and watching a hawk soar high overhead become spiritual experiences for many. These places, where city, nature, and history are mixed together in breathtaking beauty, call deeply to the psyche of urban dwellers.

The spectacular setting of ocean, windswept coastal headlands, the bay, islands, and the iconic Golden Gate Bridge has afforded San Francisco international recognition as one of the world’s most beautiful cities. The Golden Gate National Recreation Area serves as the panoramic backdrop to the Bay Area. Some of the most scenic views in the region are of the ocean and bay from lands within the park. Views of the Golden Gate Bridge, Alcatraz Island, and the Marin Headlands from sites in San Francisco have been captured in countless photographs. The Marin Headlands offer dramatic views of the San Francisco Bay and the City of San Francisco. Another important viewshed in the park is the view of Marin County park lands in the darkness. These lands are undeveloped; from San Francisco, they appear truly dark and wild, especially in comparison to the city lights on the peninsula. During scoping for this plan, the public expressed significant appreciation for the scenic qualities of the park, and concern about the long-term protection of the park’s scenic integrity.

Viewing nature is another popular activity for visitors. Raptors can be spotted from the Marin Headlands and shorebirds can be viewed along beaches. The park has an abundance of protected land populated with 1,200 plant and animal species. The area has been designated as the Golden Gate Biosphere Reserve due to the diversity of its natural

habitat. Visitors have strongly expressed a belief that the unique fauna and flora should be protected.

Learning about the area's history is also an important part of the visitor experience at the park. Military coastal defense sites are a major reason the park is preserved today. Signs of the military history are scattered throughout the park lands. Forts Baker, Barry and Cronkhite, and the fortifications along the Presidio Bluffs, offer interpretation of the structures and strategies used to defend the Bay Area. Other interpretive exhibits and programs offered by both park staff and park partners give visitors an opportunity to learn about the diverse and extensive history of the area.

Beaches play an important role in recreational activities available to visitors in the park. Over 25% of surveyed visitors to the park lands in southern Marin County went to the beach (Godbe Research and Analysis 2002). Stinson, Rodeo, Tennessee Valley, and Muir beaches in Marin County and Ocean Beach, Fort Funston, and China Beach in the City of San Francisco provide places for visitors to walk, jog, sunbathe, swim, surf, fish, play volleyball, and picnic. Visitation to these areas is highly weather dependent; heaviest use occurs during the summer months (Godbe Research and Analysis 2002).

Trails are a significant part of the park. Trails provide access so people can connect to the area's natural and historic treasures. With 196 miles of trails that range from paved surfaces to single-track paths, much of Golden Gate National Recreation Area is a paradise for walkers and hikers. Multiuse trails also serve mountain bikers and equestrians. Scenic touring on both roads and trails, including viewing scenery from overlooks reached by foot or vehicle, is a related and important visitor opportunity.

The public has expressed their strong support for the diversity of trail opportunities provided in the park. They also have noted how much they enjoy the diversity of natural landscapes, historic sites, wildlife, and native plants that are visible along the trails. Some visitors, however, are concerned about conflicts between some trail uses, particularly safety concerns between bicyclists and equestrians. In addition, some of the public is concerned that certain trail activities, such as dog walking, horseback riding, and mountain biking, might be more restricted in the future. A desire to increase the number of trails that meet the Americans with Disabilities Act requirements was also mentioned during scoping for this plan.

Overnight lodging facilities exist within the park provided by both the National Park Service and partners, including hostels at Fort Mason, Montara Lighthouse, and the Marin Headlands, and camping areas in Marin County. Overnight accommodations allow visitors to explore a trail or area more extensively than would be possible in a day trip. Overnight areas can also serve as hubs for activities, such as at Fort Mason, where visitors can explore the park and its setting from a convenient location. Camping overnight is an important experience in itself. It is an experience most often associated with more distant national parks, but made available to local populations. It also allows for the appreciation of the night sky and natural sounds that cannot be appreciated during other times.

The park and partner programs offer many opportunities to get involved in stewardship of the park. In 2008, the National Park Service and Golden Gate National Parks Conservancy team brought thousands of volunteers to the park for activities such as trail building, habitat restoration and conservation, and organized youth programs in the park.

In 2008, community volunteerism yielded over 300,000 hours of service to the park. Stewardship activities bring in thousands of school-aged children to the park, allowing all who participate to forge a deeper connection with park lands and the resources within those lands. Environmental education programs exist through partners at several sites, including Slide Ranch and Fort Cronkite. These mutually beneficial relationships between the park, its partners, and park visitors, allow the park lands to thrive at a level much higher than could be accomplished through federal funding alone.

VISITOR OPPORTUNITIES AT ALCATRAZ ISLAND

Alcatraz Island sits in a highly visible location in the San Francisco Bay and is a major visitor attraction within Golden Gate National Recreation Area, with a significant demand for visitation. Although it has been used for a variety of purposes over the years, it is best known for its service as a federal prison from 1934 to 1963. The island was opened to the public in 1973 and has become a popular tourist destination. The National Park Service and its partners offer visitors extensive interpretation of the federal penitentiary period of the island, as well as the military prison and American Indian self-determination movement. In addition, the ferry trip over to the island and many locations on the island offer great scenic viewing of the Golden Gate Bridge, the Pacific Ocean, San Francisco Bay, the City of San Francisco, and the Marin Headlands. Further, learning about the island's role in the ecological system of the Bay, including its contribution as important bird habitat, is another highlight of a visit to the island. Alcatraz Island also offers overnight experiences a few times a year through special organized events that typically involve the use of volunteers.

VISITOR USE AND CHARACTERISTICS

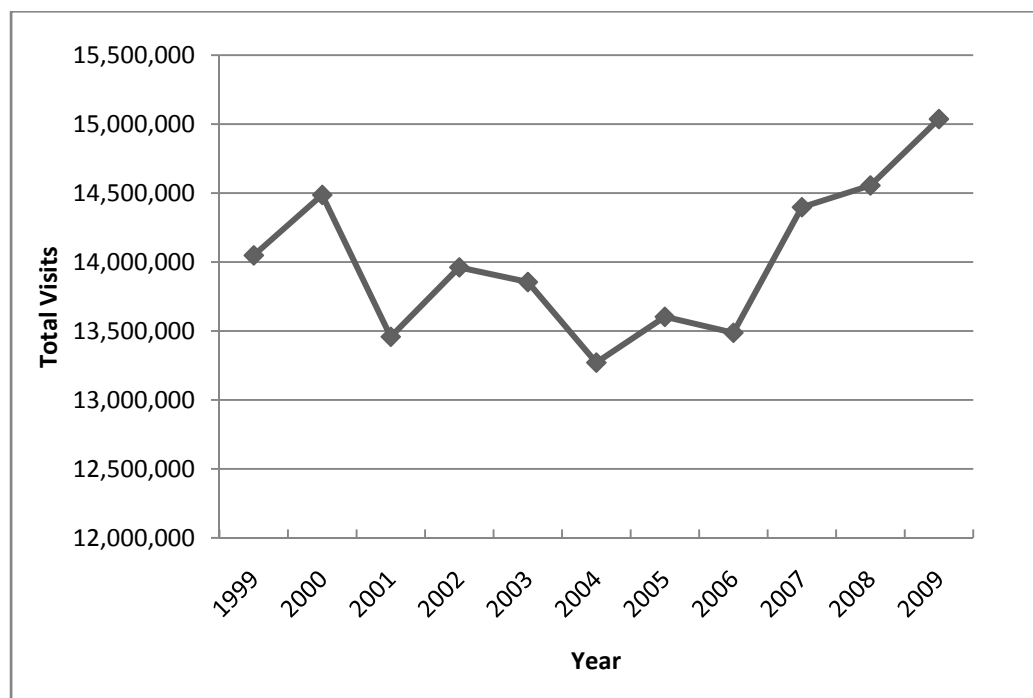
The Golden Gate National Recreation Area lands and waters serve many millions of visitors a year, making Golden Gate National Recreation Area one of the largest urban parks in the world. Extending 80 miles from north to south, the various sites of Golden Gate National Recreation Area form an expansive public green space for both the local urban population and tourists to enjoy.

In 1972, the first year that Golden Gate National Recreation Area was established, the park had over 42,000 visitors. There have been substantial increases, and a few intermittent decreases since then, but annual visitation has remained around 14 million visitors over the last 10 years (see figure 8) (NPS 2009d).

Golden Gate National Recreation Area receives about 5% of the total visitation to national parks across the nation, ranking it as the second most visited park in the park system (NPS 2009d). Many of the sites within Golden Gate National Recreation Area are located in the “backyard” of Bay Area residents who use the park lands for recreation and exercise. At many of the park sites, visitors from the local area account for the majority of visitors. Other sites, such as Alcatraz Island and the park lands of the Marin Headlands, are major tourist destinations, receiving visitors from across the nation and around the world. Visitor use levels remain relatively stable to Golden Gate National

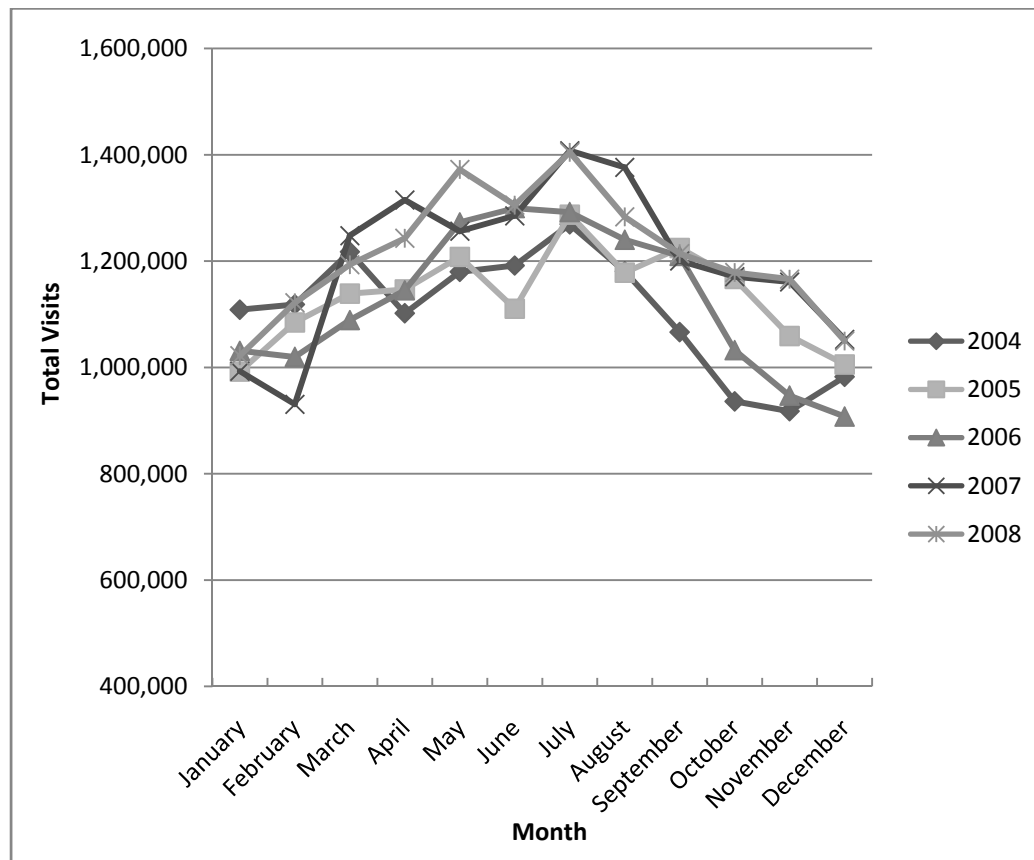
Recreation Area throughout the year, given the area’s temperate climate and year-round attractions and support services. However, the park does experience higher visitation in the spring and summer, and on holidays (NPS 2009d). See the following figure.

Figure 9: Golden Gate National Recreation Area Recreational Visitors by Year 1999–2009



The National Park Service and others have conducted numerous visitor studies in Golden Gate National Recreation Area in order to provide greater insight into the current visitor profile in terms of demographics, trip characteristics, and preferences. Although the visitor populations to the various sites within the park often vary significantly, there are several specific characteristics that the majority of park visitors share.

The collection of surveys and studies of park visitors reveal that most arrive in personal vehicles (Sheffield 2008). Visitors most often come alone or in small groups of up to four people. Day users are coming to the park to sightsee, hike, walk, spend time with friends and family, escape, find respite, enjoy nature, and participate in events. A large majority of visitors come from the local area and enjoy the undeveloped open space that is nearby and easily accessible. For instance, it was found in a recent study of visitors to the park lands in San Mateo County that a majority of visitors live close to the park—some within 2 miles—and use the park on a regular basis (Manning 2007). However, at some specific sites, such as Alcatraz Island, studies indicate a much greater mix of local and out-of-town visitors (Sheffield 2008).

Figure 10: Golden Gate National Recreation Area Visitor Use by Month, 2004–2008

Several visitor surveys of trail users have been completed at Golden Gate National Recreation Area. The surveys found that trail users come primarily for exercise, rest, and relaxation, as well as to spend time with friends and family (Sheffield 2008). Some of the areas surveyed include Point Bonita and the Marin Headlands (2006), Lands End (2005 and 2007), and Mori Point and Sweeney Ridge (2004). Trails are used by both local and out-of-town visitors, although many users are frequent visitors; up to 75% to 85% are return visitors. Trail users are generally split evenly between men and women and are generally between the ages of 20 and 55, well educated, and coming to trails alone or in pairs (Sheffield 2008).

Visitors to Alcatraz Island

Over 1.4 million visitors tour Alcatraz Island each year; this has been holding fairly steady over the recent past (NPS 2009d). On peak use days, up to 4,400 visitors travel to the island, and up to 5,000 visitors travel there on days when evening programs are offered.

Several visitor studies, conducted since 1988, reveal that Alcatraz Island has a distinct visitor profile compared to the rest of Golden Gate National Recreation Area. The island gets far more first time visitors than does the rest of the park. It also gets a larger

percentage of nonlocal and international visitors. Over 70% of visitors surveyed stayed between two and three hours on the island (Manning et al. 2007).

Characteristics of Infrequent and Nonusers

Many of the diverse groups living in the San Francisco Bay Area have not traditionally been park visitors. However, some of the factors that have served to keep them from the park have recently been studied. Some of these barriers include lack of public transportation, language differences, lack of access to information, equipment costs, and lack of time. Other barriers include a minimal representation of ethnicity and race in the park staff and perceived intolerance. Lack of knowledge, experience, and awareness of where to go, what to do, and the skills needed to partake in activities were additional factors in not visiting (Roberts 2007; Winter, Jeong, and Godbey 2004).

Although some of these groups visit the park infrequently, their interests for park visits are much the same as those of more frequent visitors. In Roberts' study (2007) of ethnic minorities and visitation constraints, participants expressed a range of preferences for recreational activities (indoor and outdoor). All groups in the study expressed a clear desire to enjoy the numerous benefits associated with outdoor recreation, along with an interest in education about national parks. Cultural connections to nature and the natural environment ranged from mental and physical benefits to spiritual and religious gains in personal life. Participants identified the benefits of parks in relation to nature being healthy, with a typical emphasis on mental health (parks as reducing stress or strains of everyday life) and in reference to increasing their connection to "God or spirituality" (Roberts 2007).

VISITOR UNDERSTANDING, EDUCATION, AND INTERPRETATION

Golden Gate National Recreation Area offers unique and varied experiences to visitors through the interpretation, education, and stewardship programs offered by the park and park partners. Interpretation is delivered through a variety of media and at a variety of locations. Opportunities to learn range from self-guided to formal educational programs, and these opportunities appeal to a variety of people and learning styles.

Participation in interpretation programs helps visitors to form their own intellectual and emotional connections with the meanings and significance of the park's resources. The park interprets its resources by several methods, including visitor center exhibits, audio tours at Alcatraz Island, ranger talks, educational brochures, and interpretive signs. Visitor and park information centers are located in Fort Mason, Marin Headlands, Pacifica, and Crissy Field. According to the 2008 *Golden Gate National Recreation Area Visitor Survey Card Data Report*, the park is meeting visitor needs, and excelling in categories such as visitor centers and sightseeing facilities (NPS 2008b). It was frequently noted during this planning process that the public places a high value on the educational and stewardship programs offered at the park and would like to see those opportunities maintained and even expanded. The public expressed specific interest in having more signs, maps, and interpretive programs available. Another request was for more opportunities to learn of the American Indian stories related to the park.

Partners of Golden Gate National Recreation Area are vital to the success of the park's efforts at promoting visitor understanding, education, and interpretation. A wide range of enthusiastic and committed partners operate within the park lands, offering visitor opportunities such as environmental education, art appreciation, children's programs, equestrian programs, marine mammal conservation, agricultural education, and conservation of the parks. Partners operate park bookstores, hostels, and other facilities that offer visitor-related services on park lands, thus enhancing and deepening visitor experiences and creating a community of park stewards. Partners also fund interpretation and volunteer efforts, as well as capital construction projects such as rehabilitation of historic structures for visitor programs. Their advocacy is integral to engaging people in the parks, and facilitating visitors' understanding of park stories and resources.

SAFE AND ENJOYABLE ACCESS AND CIRCULATION TO AND WITHIN THE PARK

(See also transportation section.)

Safe and enjoyable transportation to and within the park lands is important to the visitor experience at Golden Gate National Recreation Area. The many roads, trails, and overlooks throughout the park provide scenic viewing opportunities for visitors. There are also many transportation options for connecting visitors to park sites, including auto, bicycle, and public transit.

Further, within Golden Gate National Recreation Area are miles of trails, making it possible for hikers, bikers, and equestrians to travel great distances through park lands. The Trails Forever Program was launched in 2003 to build a world-class system of trails, which has been vital to the improvement of trails within Golden Gate National Recreation Area. Public scoping comments sometimes focused on the need for trail design improvements to make the trails safer, and the need for loop trails. Trails in all areas of the park lands could be improved to connect to neighborhoods, nearby public lands, and the regional trail network.

Currently, the majority of visitors—especially those from outside of San Francisco—arrive by personal vehicle. This sometimes causes congestion problems along roadways, in parking areas, and in nearby neighborhoods. Public transportation connections to the park are limited outside of San Francisco, so the large population of regional residents without personal vehicles cannot easily travel to the park. Although there is an extensive public transportation system that serves the City of San Francisco, some connections stop short of the park, or serve the park only on weekends and holidays. Further, there are some portions of park roads that have limited options for bicycle access. The limitations with the public transit system and bicycle access are being addressed as part of a systemwide strategic planning effort.

The ferry pier to Alcatraz Island is accessible by public transportation. However, once on the island, visitors must walk up steep roads to get to the cell house and other attractions. There is a tram available for visitors who need assistance, but the road is narrow and steep, with few turn around points or pull-off areas. Although very few incidents have occurred, conflicts between visitors and vehicles are a concern to park staff.

The Transportation Section of this document goes into further detail about the intricacies of the transportation environment to and within Golden Gate National Recreation Area.

VISITOR SAFETY

Golden Gate National Recreation Area experiences safety issues similar to those found in any national park and also faces additional visitor safety challenges due to its urban location. The park staff make considerable effort to provide safety information in easily accessible locations and formats. However, there are many points of entry to the park, and visitors are sometimes unaware and unprepared for dangers.

Urban challenges include criminal activity, crowding, and congestion that affect the ability of law enforcement to respond in a timely manner. Additionally, as visitors to the park are moving from urban areas to undeveloped open space, they may fail to bring adequate food and water, become lost in unknown areas, or get into a situation too difficult for their skill or experience level. The Point Bonita and Marin Headlands visitor survey identified a lack of trail signs that makes it difficult to stay on the correct trail (Tierney 2007). At Mori Point and Sweeney Ridge, visitors identified the lack of good information about the area as a concern (Tierney 2004).

The physical features of the land and the natural habitat can also pose safety risks. The park encompasses ocean and bay waters, which have associated dangers. At ocean beaches, rip tides are common and can be dangerous for swimmers. Visitor risks are associated with steep and crumbling cliffs.

Conflicts between users can also pose safety problems, such as those between vehicles and pedestrians, or between equestrians and bicyclists. During public scoping, people expressed concern that some trails were not designed appropriately or managed to help users avoid conflicts.

Road safety is also a component of visitor safety. Access to and from State Route 1 poses a problem at several points in Golden Gate National Recreation Area, such as at Montara Lighthouse and Sheldance Nursery in San Mateo County. In some areas, closed or unmaintained facilities may pose risks to visitors who explore them and require area closures. In particular, Alcatraz Island has a number of buildings in very poor condition that can pose safety hazards to visitors.

VISITOR USE AND EXPERIENCE – MUIR WOODS NATIONAL MONUMENT

“Time stands still in Muir Woods.” – Visitor to Muir Woods

Surrounded by the tallest living tree species in the world, visitors to Muir Woods experience a majestic and awe-inspiring setting. These majestic giants, in combination with Redwood Creek, cannot help but awe visitors and take them to a more serene place and time. The monument offers a quiet sanctuary in a growing urban setting. Conservationist John Muir summed it up best when he said “this is the best tree-lovers monument that could possibly be found in all the forests of the world.”

DIVERSITY OF RECREATIONAL OPPORTUNITIES AND NATIONAL PARK EXPERIENCES

Muir Woods National Monument offers outstanding opportunities to walk and hike among the giant redwoods. There are six miles of trails within the monument, including three loop trails. One and a half miles of trail are paved surface or boardwalk, thus providing greater access to the forest for disabled visitors. Other more challenging trails extend out of the monument and connect to nearby public lands such as Mount Tamalpais State Park and Muir Beach. Opportunities for visitors include self-guided walking tours, ranger led talks and tours, volunteer activities, and educational and restoration programs.

In visitor surveys at the monument, people identified the trees, beauty, peacefulness, trails, and other aspects of the natural surrounding as the features they most enjoyed. One visitor commented on the special ability to commune with nature while at the monument. Some visitors expressed their dislike for the crowds, noise from groups, lack of parking, and closed trails. Crowding issues primarily occur at peak times in the monument, especially on weekends and holidays in the summer. While most visitors had no suggestions for improvement, some visitors mentioned that more information and interpretation, more trails, and more parking would be appreciated (Manning et al. n.d.).

The natural soundscape at Muir Woods National Monument is a highly valued part of the visitor experience. Some members of the public complained about the noise from other visitors, particularly noise from large groups. The monument has recently implemented “quiet days” and “quiet zones” to encourage visitors to voluntarily modify their behavior to enhance the contemplative feeling of the monument’s natural setting.

VISITOR USE AND CHARACTERISTICS

While annual visitation to Muir Woods National Monument peaked in the late 1990s, it has since stabilized over the last 10 years at around 750,000 (see Figure 10). Monthly visitation varies significantly, with the summer months attracting the highest number of visitors. This is likely due to the greater numbers of out-of-town visitors, who often travel

during the summer (see figure 11) (NPS 2009). Local residents may also visit Muir Woods more often in the summer when children are out of school.

Muir Woods National Monument, like Alcatraz Island, has been the focus of many visitor surveys. Studies conducted between 2003 and 2005 provide good demographic information on visitors (Manning et al. n.d.). For example, 72% of visiting groups are families with the majority of groups consisting of 2 to 4 people. Over half of the survey respondents were first-time visitors, suggesting that Muir Woods is an important urban gateway to the national park experience. Ninety-two percent of visitors were from the United States, with almost 40% of domestic visitors residing in California. The educational attainment of visitors was very high; about 80% of all visitors had a post-secondary degree. Most visitors were there for less than four hours (Manning et al. n.d.).

Figure 11: Muir Woods National Monument Recreation Visitors by Year, 1999–2009

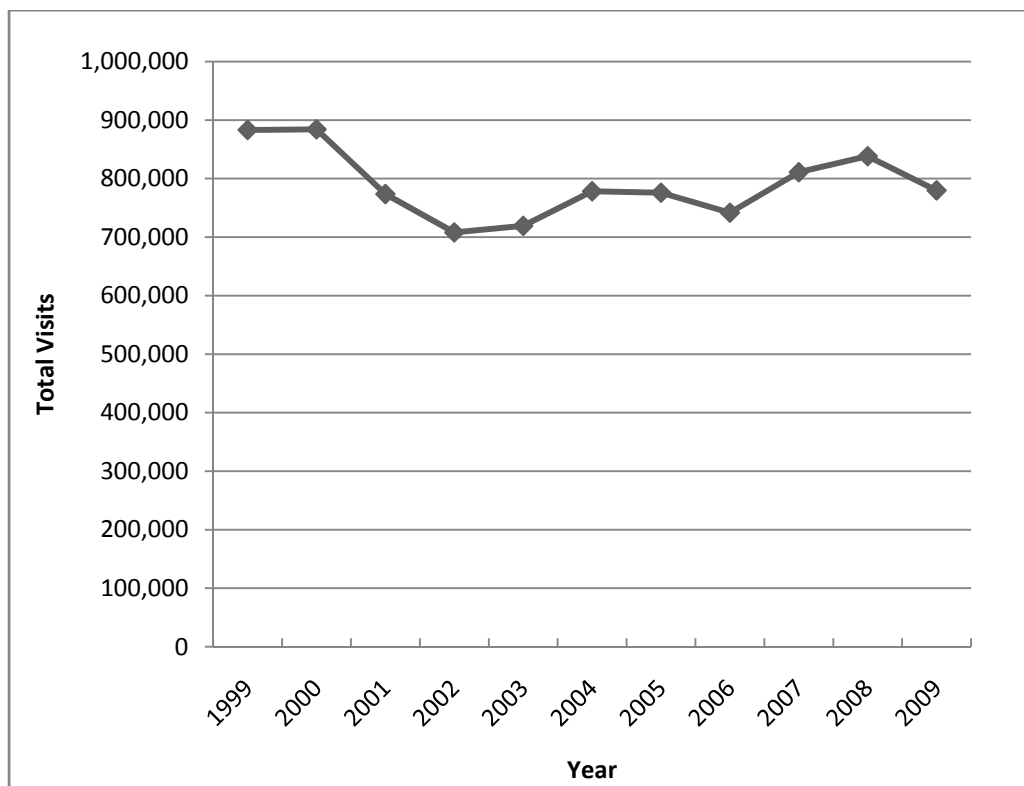
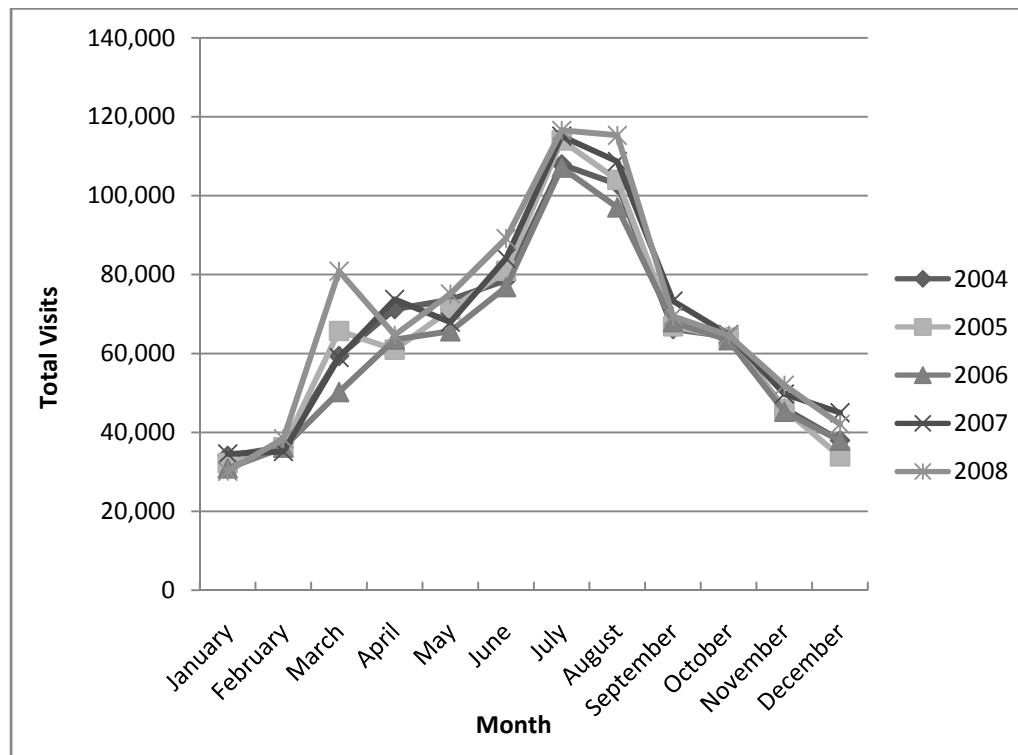


Figure 12: Muir Woods National Monument Visitor Use by Month, 2004–2008

VISITOR UNDERSTANDING, EDUCATION, AND INTERPRETATION

The stories of Muir Woods are many: the ecology of the watershed, the natural history of the redwood forest, the history of the conservation movement, and the establishment of the biosphere reserve. There are various ways in which visitors can learn these stories: at the visitor center with exhibits and information; on a self-guiding walk; by attending ranger talks, tours, or evening programs; and by attending a junior ranger program. In addition, the monument staff collaborate with many local organizations that offer learning and educational programs, thus expanding the interpretive and educational offerings available to visitors.

In public scoping for this plan, some people commented that they particularly appreciate the messages associated with the preservation values of the monument and its connection to conservation history. A few others noted that additional information and signage at Muir Woods National Monument would be desirable to enhance knowledge about the ecosystem processes.

SAFE AND ENJOYABLE ACCESS AND CIRCULATION TO AND WITHIN THE PARK (SEE ALSO TRANSPORTATION SECTION)

For many visitors, traveling to Muir Woods National Monument at peak times can be a frustrating experience. The parking lot fills up quickly, and often people resort to parking along the road. For example, during the 2003 visitor study, researchers found that 92% of visitors arrived by car, and of those, 76% were able to park in parking lots, with the remainder having to park along the road (Manning et al. n.d.).

It is likely that some visitors who drove to the monument may have left when faced with no easily accessed parking options. Public transportation via shuttle is now available on weekends and holidays in the summer, but at other times, there is no public transportation service to the monument. The shuttle system, implemented in 2004 to help ease the parking limitations at the monument, has improved access for visitors. Once within the monument, visitor access is by walking and hiking on trails. The monument has three loop trails, and 1.5 miles of accessible paved or boardwalk trail. There is also trail access from nearby public lands, including Mount Tamalpais State Park.

VISITOR SAFETY

A safety concern mentioned by members of the public relates to access to the monument. The road to Muir Woods National Monument is narrow, winding, and steep in parts. Comments indicated that larger vehicles do not always stay in their lanes on the curves, causing danger to oncoming traffic, including vehicles and bicycles. In addition, roadside parking at the monument results in real and perceived safety dangers for visitors who must traverse the road to gain access to the monument's entrance.

SOCIAL AND ECONOMIC ENVIRONMENT (INCLUDING BOTH GOLDEN GATE NATIONAL RECREATION AREA AND MUIR WOODS NATIONAL MONUMENT)

INTRODUCTION

The social and economic conditions of the Bay Area and the gateway counties of Marin, San Francisco, and San Mateo influence Golden Gate National Recreation Area and Muir Woods National Monument and how they are managed. Conversely, the park and monument directly contribute to the social and economic conditions of these three counties and the Bay Area as a whole. This section describes the existing conditions related to this relationship by highlighting the park's quality of life benefits as well as the Bay Area's demographic and economic trends.

The San Francisco Bay Area is not only one of the most diverse metropolitan areas in the United States, it also has a unique culture and community ethic that distinguishes itself from most other American urban centers. Generally speaking, the Bay Area's cultural identity exhibits an intrinsic sense of awareness, stewardship, and activism toward social and environmental issues.

This section summarizes the existing social and economic conditions in the Bay Area, as well as in the three counties most affected by Golden Gate National Recreation Area and Muir Woods National Monument (Marin, San Francisco, and San Mateo). The section also includes projections of how some of these conditions may change over the next 20 years, which is the planning horizon of the park's general management plan. To maintain consistency with regional demographic analyses, the term "Bay Area" in this section will refer to the nine-county region defined by the Association of Bay Area Governments. The nine counties of the Bay Area are Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma.

THE IMPORTANCE OF PARKS TO A COMMUNITY

Park and open space areas in and around an urban area are key contributors to the quality of life in the community. This becomes even more significant in very large metropolitan areas, where population densities and the travel distance to open, public lands are greater. The San Francisco Bay Area is the fifth largest metropolitan area in the United States. Thus, the park and monument play a vital role in sustaining and enhancing the quality of life for the residents of the Bay Area. The significance of this role becomes more evident when we consider the following four specific ways parks and open space contribute to quality of life.

“Woven into the Fabric” of the Bay Area

In a literal sense, the size, geographic orientation, and location of Golden Gate National Recreation Area within the Bay Area make the park a large physical component of this metropolitan area. The public lands of Golden Gate National Recreation Area serve as a natural and scenic backdrop to the urban landscape of the Bay Area by day and an open expanse of darkness by night. In addition, the park’s close proximity to the urban centers of the Bay Area elevates its importance. However, equally important and in a more figurative sense, Golden Gate National Recreation Area is “*woven into the fabric*” of the Bay Area community. The park is part of the community and the community’s identity. The themes and aesthetics of the various park components help feed the conservation ethic of the Bay Area community. In turn, this community ethic fuels the residents’ valuation and appreciation of the park and its intrinsic natural and cultural resources. This cyclical dynamic helps strengthen the bond between the community and the park and helps sustain a heightened quality of life for the community residents.

Community Building

On a related but distinct note, Golden Gate National Recreation Area helps instill a sense of community in the Bay Area. This community-building effect occurs on two primary levels. First, the many diverse park resources and features help provide a sense of community identity for Bay Area residents. Many of the landmarks, natural wonders, and amenities of the park are not only known on a local or state level, but also admired at a national and international level. For example, many people around the U.S. and throughout the world identify with the Bay Area by thinking of the coastal redwoods of Muir Woods National Monument, historic sites such as Alcatraz Island, or even the idyllic views of open lands and water around the San Francisco Bay. This local and global admiration contributes to a sense of identity and pride in being a resident of the Bay Area community. Just as residents may identify with the community via its cultural diversity, culinary quality, free spirit, or even 49ers or Raiders, they also find a sense of identity with the many attractions of Golden Gate National Recreation Area.

Secondly, Golden Gate National Recreation Area contributes to community building by providing numerous park sites and open lands for the diverse residents of the Bay Area to congregate and socialize. Parks are one of the most effective ways to build a sense of community and enhance quality of life by providing common places for people to interact in a shared environment (Francis 2006). Urban parks are one of the few public places where people of diverse cultures, ethnicities, ages, and lifestyles can congregate and communicate openly in a community.

Health Benefits for Bay Area Residents

In addition to community benefits, Golden Gate National Recreation Area also helps enhance the Bay Area quality of life by improving the psychological and physiological health of the Bay Area residents. A recent report by California State Parks indicates that, “Two-thirds of Californians consider outdoor recreation important to their quality of life” (California State Parks 2005).

An urban interface park such as Golden Gate National Recreation Area can help improve the community’s health by offering residents opportunities for personal fitness, active

recreation, and other physical exercise. A 2001 Center for Disease Control task force report indicated that regular physical activity correlates with a prolonged life expectancy and enhanced health, including a reduced risk for cardiovascular disease, obesity, diabetes, some cancers, and musculoskeletal conditions. The report also notes that only 25% of U.S. adults report engaging in adequate physical activity. As a result of this shortfall, the CDC task force “strongly recommended” that communities improve access to places that offer physical activity (e.g., hiking and biking trails, parks) (CDC 2001). In turn, evidence shows that when people have access to parks, they tend to exercise more. Research also indicates that contact with the natural world improves physical and psychological health (Sherer 2006). Golden Gate National Recreation Area helps satisfy these essential community needs in the Bay Area.

In terms of psychological or mental health benefits, regular physical activity can reduce the severity of many mental health disorders, alleviate depression, and decrease stress and anxiety (California State Parks 2005). Furthermore, even if a park visitor opts for a less-active, more relaxing park experience, an urban park such as Golden Gate National Recreation Area can provide an open and free feeling that helps offset the more congested feeling that can be generated by high-density urban living.

The park also contributes several other community health benefits for Bay Area residents. For example, the numerous attractions and open areas of the park offer a place for children to stay active, safe, and socially engaged. A community that offers a healthy environment for children reaps numerous social benefits in the short and long term, as the kids have ample opportunities to learn, socialize, exercise, and get “hands-on” exposure to the natural world. During the comment period for the preliminary alternatives for this plan, many children submitted letters that expressed the importance of various park features to them. Comments such as “It teaches kids how to love nature” and “kids learn and discover lots of cool stuff” were plentiful.

The Increasing Value of Golden Gate National Recreation Area

A fourth contributor to the Bay Area’s quality of life relates to how the community value of the park’s open spaces increases over time as population growth and urban sprawl continue in the region. As of 2007, the Bay Area had a population of roughly 7 million. By 2035, the Association of Bay Area Governments projects that the population of this nine-county region will grow by 2 million people (ABAG 2007). With this population growth on the horizon, housing production will need to increase as well. In recent decades, a significant amount of Bay Area housing growth has occurred along the fringes of the Bay Area to accommodate the population growth. This fringe development resulted in an expanded urban area and a decrease in open and agricultural land in the Bay Area. This trend will likely continue over the next 20 years, along with additional infill development in existing urban areas. As a result, the anticipated population and housing growth in the future will displace a significant volume of land that is currently open, undeveloped, or agricultural. Moreover, with every acre of open land that is displaced by urban development, the community value of every acre of existing park land will increase.

This “increasing park value” dynamic has other implications that need to be considered in park planning. As Golden Gate National Recreation Area lands become more and more important (and unique) as urban growth continues, pressure will likely mount to allow

more intense and nontraditional uses on these park lands. With higher population densities and less available open land in the Bay Area, both public and private interests may petition for uses such as municipal infrastructure corridors, public parking, or as places for more active and consumptive recreational uses. So, just as park lands may become more precious to the community, they also may become more at risk from demands other than the demand for preservation of open space.

POPULATION AND COMMUNITY TRENDS

The current and future management of the park and monument is directly affected by the population dynamics and composition of the communities that surround it. With the majority of visitors being Bay Area residents, the visitation and involvement from the local Bay Area communities play an integral role in sustaining the park. As the population grows, there will be an increase in visitor use and demands for the park to accommodate traditional and new outdoor recreation opportunities.

General Description of Overall Bay Area Community

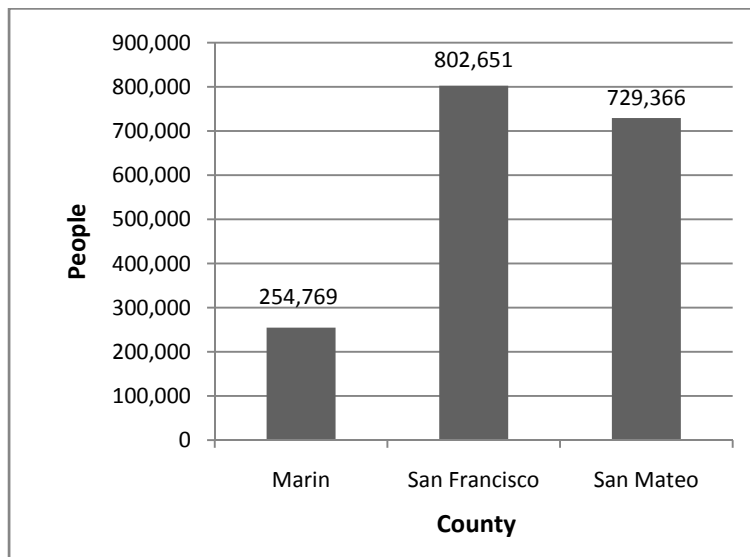
The nine-county Bay Area is generally centered on San Francisco Bay. The urban lands of the Bay Area include 101 cities, with three primary urban centers (San Francisco, Oakland, and San Jose). About half of the projected population increase in the Bay Area over this planning horizon is due to the difference between the number of births and deaths; the other half is due to expected migration into the area—as a result of abundant employment opportunities (ABAG 2008).

The Population...by the Numbers

The Bay Area population grew steadily from 2,681,332 in 1950 to 6,783,760 in 2000 (U.S. Census Bureau, 2009). As of 2006, the Bay Area population estimate was 7,167,500. Over the next 20 years, the region's population will continue to grow to a projected 8,709,000 people by 2030. Although the projected population growth is significant, the growth will not be distributed evenly throughout the Bay Area's nine counties. The vast majority of the growth (both numerically and by percentage) will be occurring in the eastern counties, such as Alameda, Contra Costa, Santa Clara, and Solano counties, where more developable land exists. This substantial population growth in the fringe areas of the Bay Area will contribute to future increases in park visitation. Also, given the longer travel distance and more limited transportation options from these eastern areas to the park, shifts may occur in visitor use patterns (e.g., duration of stay, preferred park destinations, number of vehicles in park).

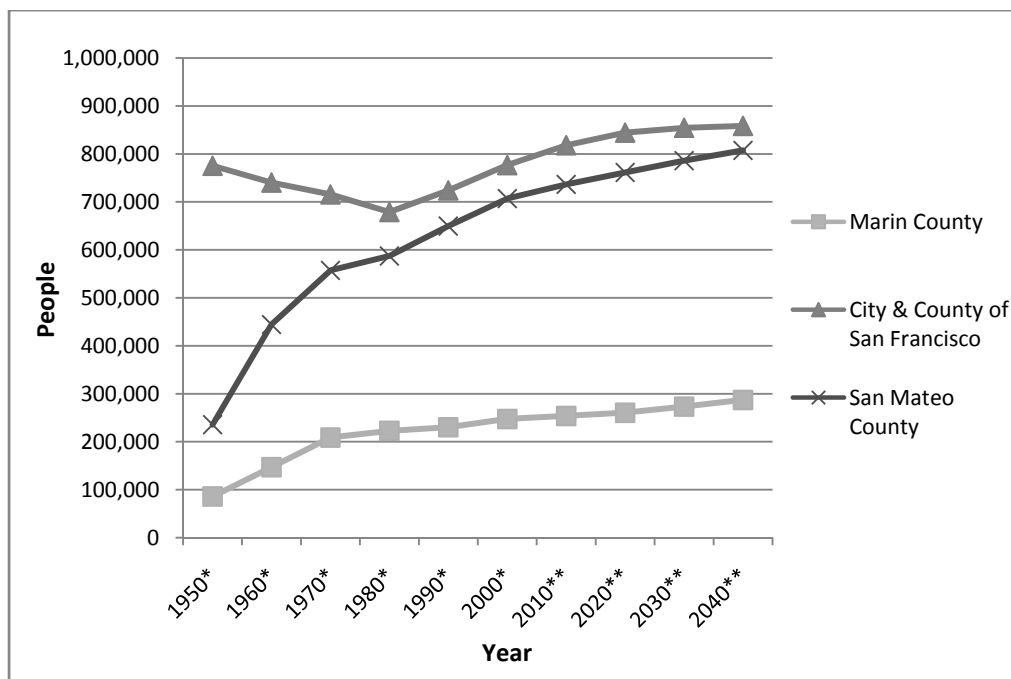
Although most population growth is forecast for these eastern fringe counties, a modest level of infill population growth is also expected in the park's gateway counties of Marin, San Francisco, and San Mateo (see following two figures). Given San Francisco's larger population on its relatively small land area of the peninsula, San Francisco's population density is over 30 times greater than the Bay Area average.

Figure 13: 2006 Estimated Populations of Gateway Counties



Source: California Department of Finance, Demographic Research Unit and Economic/Financial Research Unit, 2009. <http://www.dof.ca.gov/>

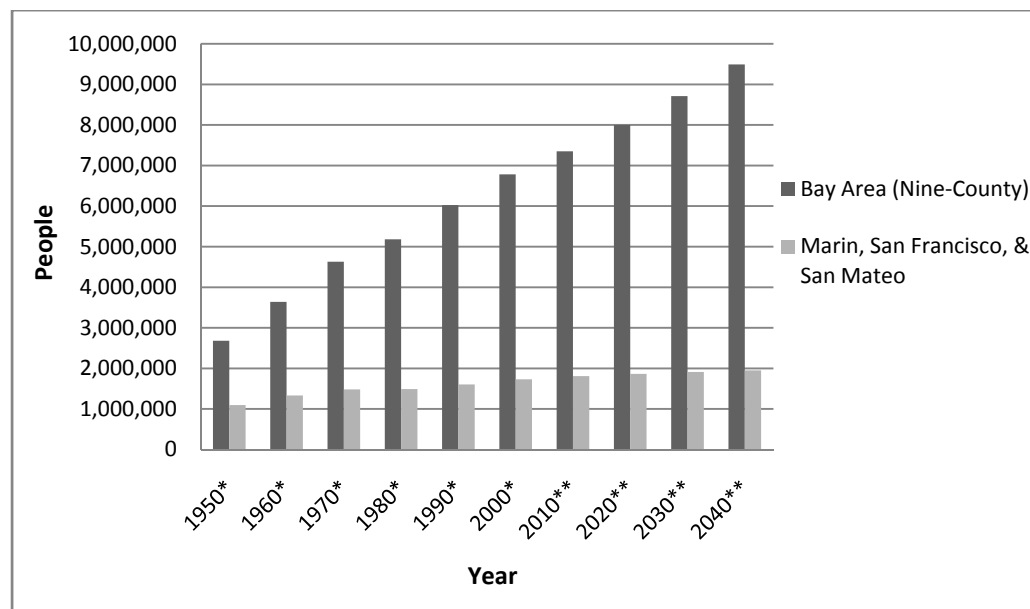
Figure 14: Past and Projected Population Growth of Golden Gate National Recreation Area Gateway Counties



Sources: * U.S. Census Bureau, 2009.; ** California Department of Finance – Demographic Research Unit, 2009.

Cumulatively, the three gateway counties will account for about 8% of the projected population growth in the overall Bay Area by 2030. As displayed in the following figure, the three counties of Marin, San Francisco, and San Mateo will become an increasingly smaller component of the overall Bay Area population, given the west-to-east shift in future population growth. In 1970, these three counties accounted for roughly one-third of the total Bay Area population. Over the next few decades, Marin, San Francisco, and San Mateo will account for only about one-fifth of the Bay Area population. Despite having access to other local and regional parks closer to home, it is likely that people in these more distant communities of the Bay Area will still seek the unique and distinct experiences provided at the park and monument.

Figure 15: Past and Projected Population Growth of Golden Gate National Recreation Area Gateway Counties Relative to Overall Bay Area



Sources: * U.S. Census Bureau, 2009.; * California Department of Finance – Demographic Research Unit, 2009.

The People and the Households

In addition to assessing the status and forecast for overall population growth in the Bay Area, it is also important to understand the changing characteristics of area residents and the composition of the community's households. This section discusses the community characteristics of median age, household size, race, income, poverty levels, and education levels.

Median Age and Household Size

As of 2007, the Bay Area had a median age of 37.7 years. Marin, San Francisco, and San Mateo counties had median ages of 43.8, 39.5, and 39.7, respectively. The average household size in the Bay Area at that same time was 2.70 people per household. Marin County and the City and County of San Francisco both had lower average household

occupancies, which were 2.35 and 2.30 people per household, respectively. San Mateo County's average household size of 2.75 people per household was slightly higher than the Bay Area average (U.S. Census Bureau 2008).

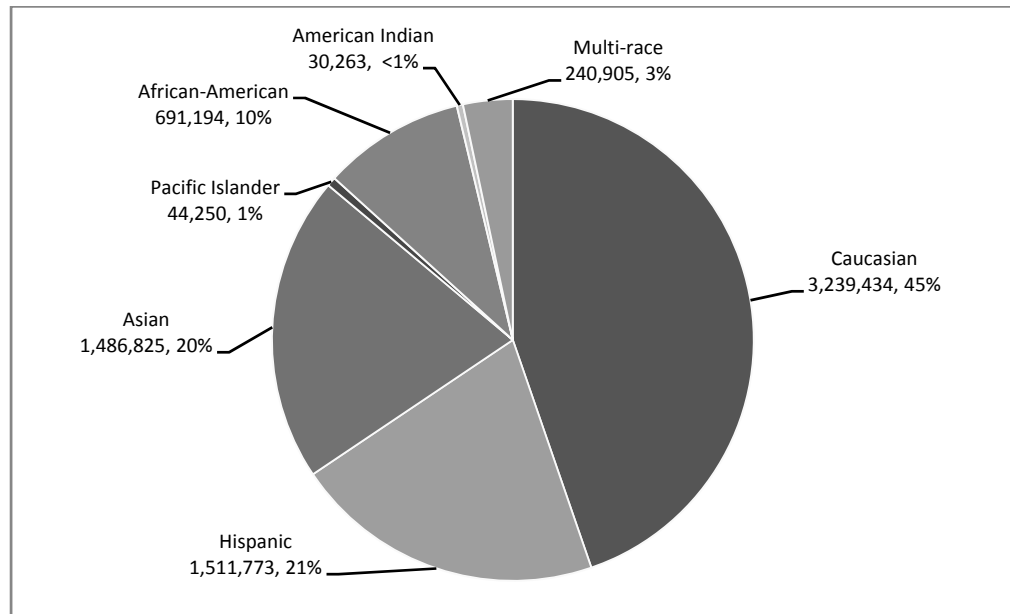
These community characteristics are expected to shift over the next 25 years due to societal changes and economic conditions. By 2035, the Association of Bay Area Governments is anticipating an increase in the Bay Area's median age to 42.5 years. The expansion of these older age groups will primarily be due to an aging population and increasing average life spans (ABAG 2007). This is consistent with other projections for the entire state of California, which indicate that the number of citizens over the age of 65 in California will double by 2020 (Roberts 2007). The Association of Bay Area Governments also anticipates that more and more people will likely be working beyond their "retirement years" over the next few decades. With a larger number of older people employed, the Association of Bay Area Governments predicts that a higher percentage of older people will be living in urban areas, which provide better public transportation opportunities and job opportunities. This trend may eventually place higher demands on public transit systems in the Bay Area, and may perhaps generate a greater need for water transport across San Francisco Bay and other bays in the region.

In addition, by 2035, the Association of Bay Area Governments anticipates that the average household size will decrease due to a percentage increase in one- and two-person households. This projection is based on the likelihood that 1) more young professionals will continue to choose not to have children or will wait longer before having them; and 2) children will be growing up and leaving the existing family households (ABAG 2007).

Race

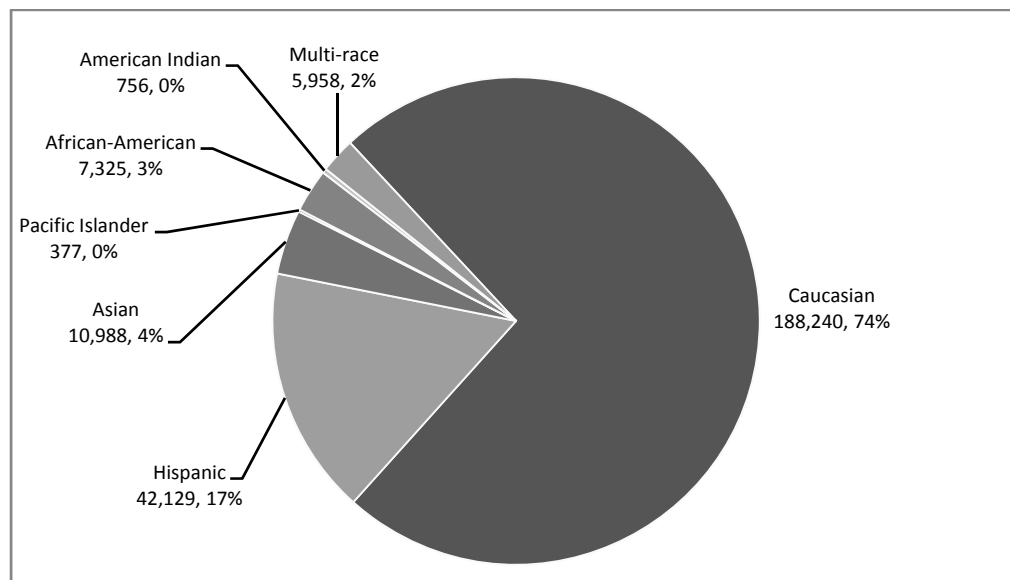
Racial diversity is one of the Bay Area's unique characteristics. The following four figures show the 2007 population estimates and percentages for each racial group in the Bay Area as a whole and in each of the three adjacent counties. From a park management standpoint, understanding the racial makeup of the community can help shed light on ways to make the park more inviting, develop better outreach with the community, and improve park program relevance. In addition, this awareness contributes to improving the quality of life in the community. As discussed in the "Visitor Use and Experience" section, many people from the Bay Area's diverse racial, ethnic, and cultural groups are not visiting Golden Gate National Recreation Area due to social "barriers" (Roberts 2007).

Figure 16: 2007 Population Estimates in Bay Area, by Race



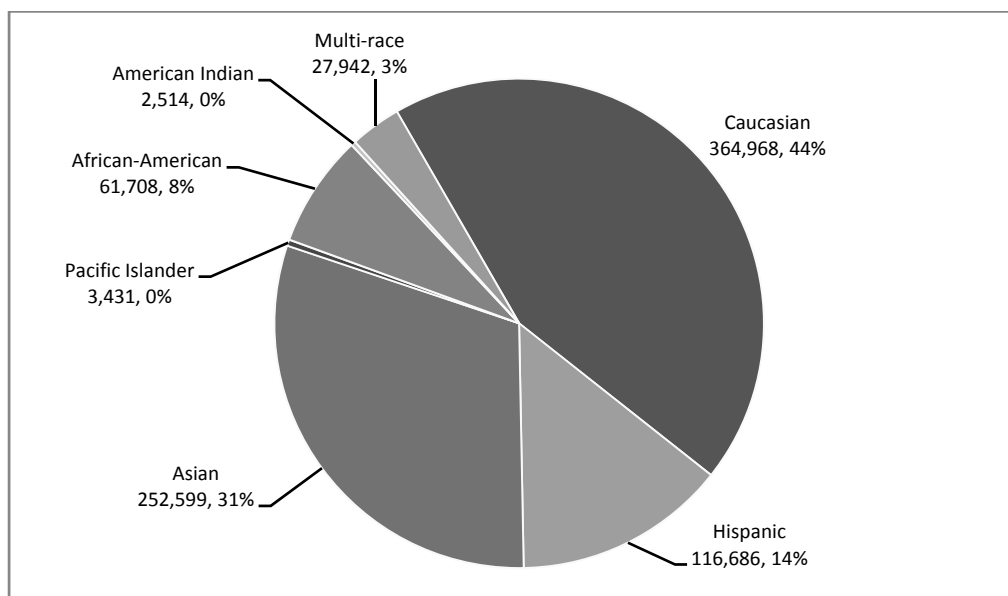
Source: California Department of Finance – Demographic Research Unit, 2009.

Figure 17: 2007 Population Estimates in Marin County, by Race



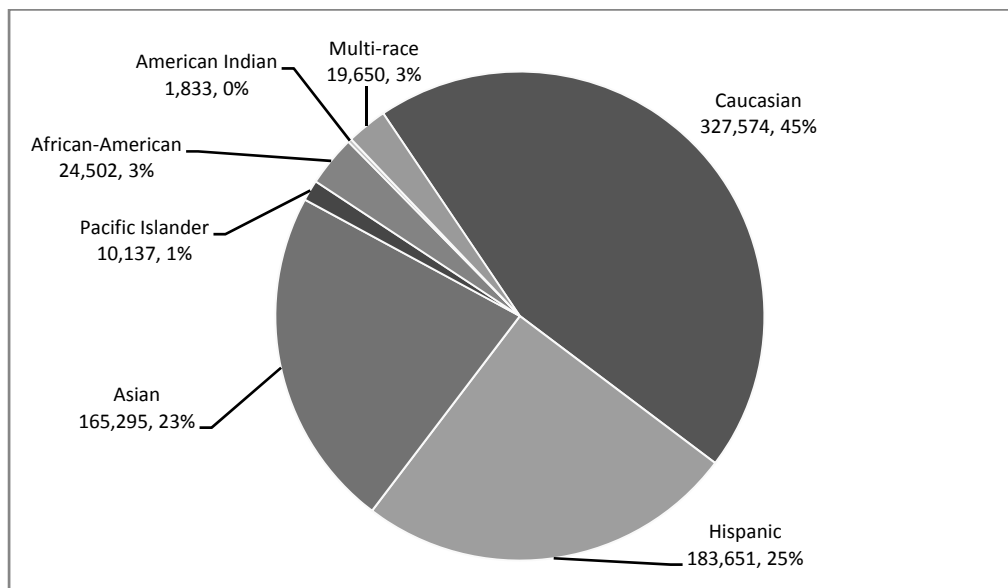
Source: California Department of Finance – Demographic Research Unit, 2009

Figure 18: 2007 Population Estimates in San Francisco, by Race



Source: California Department of Finance – Demographic Research Unit, 2009.

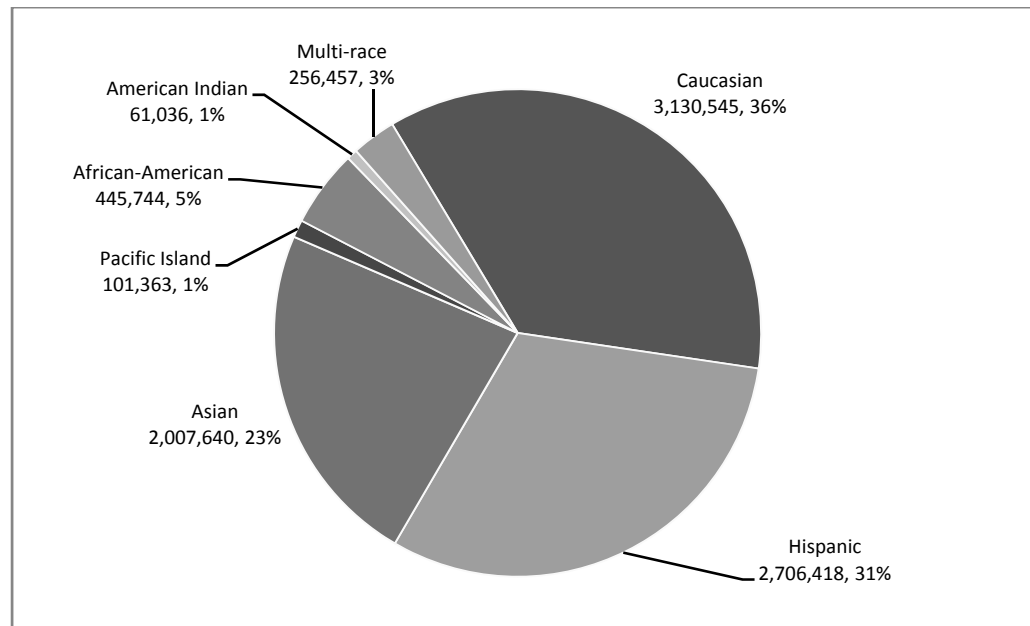
Figure 19: 2007 Population Estimates in San Mateo County, by Race



Source: California Department of Finance – Demographic Research Unit, 2009.

Just like the other community attributes, race percentages in the Bay Area will be shifting over the next few decades. By 2030, the California Department of Finance Demographic Research Unit projects that roughly 90% of the overall Bay Area population will be somewhat evenly divided among Caucasian, Hispanic, and Asian residents. This shift can be seen by comparing the following figure with figure 15 for Bay Area racial composition. This significant increase in the population of various minority racial and ethnic groups over the next 20 years further emphasizes the importance and need for the National Park Service to improve outreach and eliminate barriers that might keep people of all races and ethnic groups from experiencing the park.

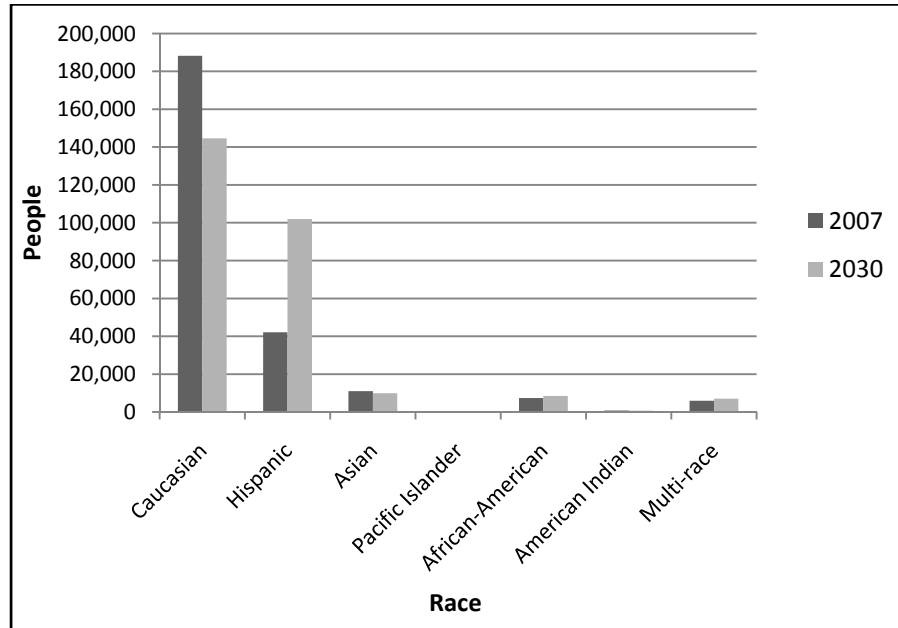
Figure 20: 2030 Population Estimate in Bay Area, by Race



Source: California Department of Finance – Demographic Research Unit, 2009.

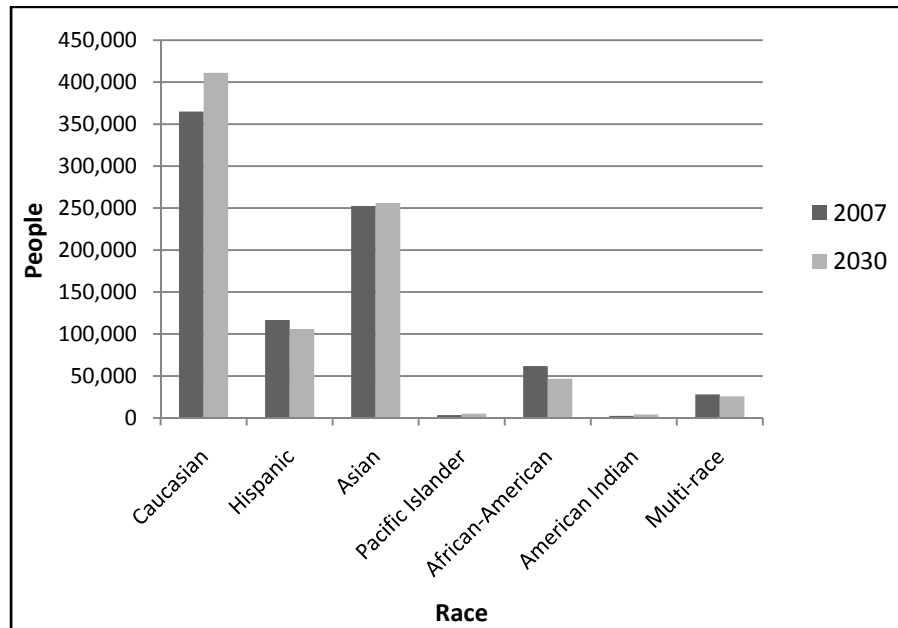
In the three gateway counties, the racial percentage shift from the present to 2030 varies considerably (see the following three figures).

Figure 21: Population Estimate by Race in Marin County in 2007 and 2030



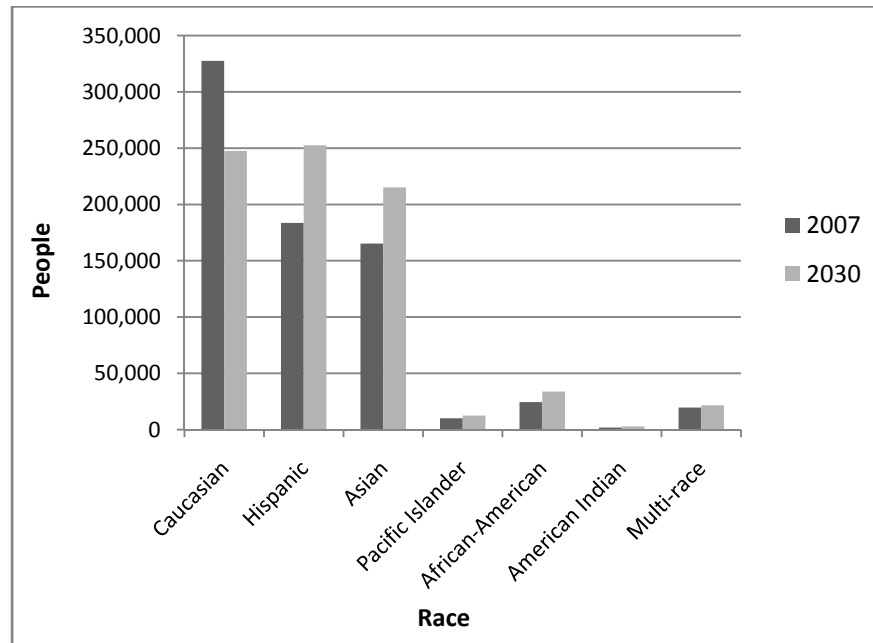
Source: California Department of Finance – Demographic Research Unit, 2009.

Figure 22: Population Estimate by Race in City & County of San Francisco in 2007 and 2030



Source: California Department of Finance – Demographic Research Unit, 2009.

Figure 23: Population Estimate by Race in San Mateo County in 2007 and 2030



Source: California Department of Finance – Demographic Research Unit, 2009.

Income, Poverty, and Education

Another factor that plays a role in park management and visitation trends is the income levels and poverty levels of residents who live in the vicinity of the park. A statistic from the California Department of Finance indicates that the three counties with the highest per capita incomes in the state as of 2005 were Marin, San Francisco, and San Mateo. In 2005, Marin County had a per capita income of \$75,844 (the highest in the state), with San Francisco at \$62,614 and San Mateo at \$59,213 (California Department of Finance 2009).

As of 2007, 9.3% of the Bay Area’s population was living below the poverty level, which was notably lower than the statewide figure of 12.7% (U.S. Census Bureau 2005–2007; American Community Survey 2008). Marin and San Mateo counties had even lower poverty rates in 2007: 7.0% and 6.7%, respectively. The City and County of San Francisco had a 2007 poverty rate of 11.7%.

The level of education attained by community residents can often correlate to the aforementioned income and poverty characteristics. The following table lists the percentage of residents in each area (25 years or older) who attained various levels of education as of 2007. Generally, the Bay Area education levels are notably higher than that of the state of California as a whole (U.S. Census Bureau 2008).

Table 6: Percentage of 2007 Population (25 or older) Reaching Various Levels of Education

	California	Bay Area	Marin	San Francisco	San Mateo
No high school diploma (or equal)	20%	14%	8%	15%	12%
High school diploma (or equal)	23%	20%	14%	15%	19%
Some college, but no degree	20%	19%	18%	14%	19%
Associates degree	8%	7%	6%	5%	7%
Bachelors degree	19%	25%	31%	31%	27%
Graduate or professional degree	10%	16%	23%	19%	16%

Source: U.S. Census Bureau, 2005–2007 American Community Survey, 2008.

Housing and Urban Growth

This section will identify current and projected trends in the housing market and highlight housing indicators such as home values, housing affordability, own/rent ratios, and single-family/multifamily dwelling ratios. One of the most notable characteristics of the Bay Area housing market is its very high home prices and values. Several variables affect home prices in this area. However, generally speaking, the Bay Area's expensive housing is a result of a high level of housing demand (due to population growth over the past several decades) coupled with a low level of housing construction (ABAG 2008).

Compounding matters, high housing costs also result from an imbalance in available housing types, as primarily large, single-family housing units have been planned and built in many suburban Bay Area communities; these housing options may not meet the needs of area residents (ABAG 2007).

According to the U.S. Census Bureau's 2005–2007 American Community Survey, the 2007 median home value in the Bay Area was \$676,800. In the same year, Marin County had a median home value of \$895,100; San Francisco's median home value was \$789,400; and San Mateo County had a median home value was \$807,400. However, because the majority of San Francisco housing consists of attached, multifamily units, the price per square foot in San Francisco is likely higher than that in surrounding areas (see following table) (U.S. Census Bureau 2008).

Table 7: Percentage of 2007 Housing Stock, Detached and Attached Housing

	Bay Area	Marin	San Francisco	San Mateo
Single-family, Detached	64%	71%	34%	68%
Multifamily, Attached	34%	28%	66%	31%

Source: U.S. Census Bureau, 2005–2007 American Community Survey, 2008.

Given the high housing costs, many Bay Area residents cannot afford to own a home. In 2007, only about 15% of Bay Area households could afford a median-priced home. With the projected decrease in Bay Area household size, and the projected increase in the number of senior citizens who may be living (and possibly still working) in urban areas, demands for more compact urban housing units will likely increase. This demand may shift the housing production trends in the high demand urban areas of the Bay Area. The Association of Bay Area Government's FOCUS initiative is one multijurisdictional effort that may complement this dynamic. FOCUS is a regional planning strategy that promotes efficient and compact land development, which in turn maximizes open land conservation. The strategy also acknowledges the transportation link by encouraging the development of livable communities in areas served by public transportation.

As discussed earlier, the projected population growth in the eastern counties (Solano, Alameda, Contra Costa, and Santa Clara) will likely spur additional low-density, single-family housing development, and a subsequent reduction of open space or undeveloped lands in these areas.

Table 8: Percentage of 2007 Housing Stock, Owner-occupied and Renter-occupied Housing

	Bay Area	Marin	San Francisco	San Mateo
Owner-occupied	60%	65%	38%	63%
Renter-occupied	40%	35%	62%	37%

Source: U.S. Census Bureau, 2005–2007 American Community Survey, 2008.

ECONOMIC EFFECTS OF THE PARK ON THE COMMUNITY

Just as population growth and community demographics have effects on the management and use of Golden Gate National Recreation Area, the park has effects on the economy of the community around it. Like many other economic engines in the Bay Area (e.g., high-tech and finance industries), Golden Gate National Recreation Area and Muir Woods National Monument contribute to the local and regional economy by generating business and revenue, creating jobs, and indirectly fueling economic growth in other industries. This section identifies these economic impacts of the park and monument and provides a synopsis of the overall Bay Area economy.

The Park's Contribution to the Economic Stability of the Bay Area

The park and monument have many direct and indirect positive effects on the Bay Area's economy. This impact can be traced to several sources and attributes, such as money spent by visitors at local businesses, jobs created at these local businesses due to the visitor demands, NPS jobs created at the park and monument, NPS contracts with local businesses, and other Bay Area tourism generated by the park and monument. This section will highlight some of these factors and explain the relevance to the overall Bay Area economy.

Contributions to Local Economy from Golden Gate National Recreation Area Visitor Expenditures

Each year, millions of park and monument visitors contribute hundreds of millions of dollars to the Bay Area economy. This money directly sustains the revenue stream and jobs at hotels, restaurants, and stores that serve park visitors. Primarily, businesses in the gateway counties of Marin, San Francisco, and San Mateo are the direct beneficiaries of this economic contribution. In addition, the visitor money stream can also have other indirect, or secondary, effects. For example, this injected money that directly supports local businesses and jobs eventually recirculates further into the Bay Area economy and beyond. This recirculation happens when the gateway local businesses buy products or services from other sources (e.g., from wholesale suppliers), or when employees at the local businesses use their income earned at the local gateway business at other businesses in the area to sustain their lifestyle (e.g., grocery shopping, entertainment). This secondary effect is often referred to as an economic "multiplier," as one dollar injected into the local economy often has more than one dollar of effect in the local economy.

With funding from the NPS Social Science Research Program, researchers at Michigan State University have created the NPS "Money Generation Model 2" (MGM2) to measure these direct and indirect contributions from visitors to local economies. Dr. Daniel Stynes and Dr. Dennis Propst used the MGM2 to analyze the effect that park and monument visitors had on the local economy in 2003. The following table lists the 2003 visitation totals and the associated spending for each visitor type. "Visitor Party Days" refers to the number of days each visitor party or group spends in the Bay Area.

As noted in the table, local day trips accounted for 80% of all park and monument visitation in 2003, with each local day trip party spending an average of \$32 per day. Understandably, hotel-based visitor parties spent much more locally per day (\$229 per day). When all visitor types are included, the average park visitor party spent \$43 at local

businesses per day. When these visitor expenditures are totaled for the entire year, the MGM2 estimates that park and monument visitors directly injected \$226,810,000 into the local economy in 2003.

Table 9: 2003 Visits and Estimated Spending, by Visitation Type

	Local Day Trips	Nonlocal Day Trips	Hotel	Camp	Total
Recreation Visits	11,036,074	2,069,264	730,271	19,141	13,854,750
Percentage of Recreation Visits	80%	15%	5%	<1%	100%
Visitor Party Days	4,216,401	790,575	244,090	5,915	5,257,245
Avg. Spending Per Party Day	\$ 32	\$ 47	\$ 229	\$ 91	\$ 43
Total Spending (million's)	\$ 132.89	\$ 37.48	\$ 55.87	\$ 0.55	\$ 226.81

Source: Daniel Stynes, Ph.D. & Dennis Propst, Ph.D., Michigan State University, "Economic Impacts of Visitor Spending, by Parks" NPS Money Generation Model 2 (MGM2), 2003.

The model estimates in the following table show how this injected money circulated through the local economy. Both direct and secondary effects are included. The direct effects of these visitor expenditures include sales, income, and jobs in businesses selling goods and services directly to park visitors. Thus, the \$226.81 million in visitor spending supported an estimated 4,107 jobs, as well as \$176.96 million in sales and \$67.05 million in personal income (wages and salaries.) As for secondary, or multiplier effects, an additional \$94.13 million in sales and \$34.31 million in personal incomes were generated by park spending as the money circulated through the local economy. An additional 1,194 jobs were supported by this secondary effect. When all of these effects are totaled, the \$226.81 million in visitor spending supported a total of \$271.09 million in sales, \$101.35 million in personal income and 5,300 jobs in the community.

Table 10: 2003 Estimated Economic Contributions of Golden Gate National Recreation Area Visitor Spending, By Sector

Sectors	Sales (millions)	Personal Incomes (millions)	Jobs Supported	Value Added (millions)
Direct Effects				
Motel, Hotel, B&B and Cabins	\$ 26.39	\$ 9.34	489	\$ 14.19
Campsites	\$ 0.13	\$ 0.05	2	\$ 0.07
Restaurants & Bars	\$ 63.84	\$ 22.67	1,725	\$ 31.58
Admissions & Fees	\$ 30.03	\$ 10.61	819	\$ 17.36
Retail	\$ 35.49	\$ 18.10	870	\$ 28.28
Others	--	\$ 6.28	201	\$ 9.80
Total	\$ 176.96	\$ 67.05	4,107	\$ 101.29
Secondary Effects				
Secondary Effects	\$ 94.13	\$ 34.31	1,194	\$ 58.51
Total Effects	\$ 271.09	\$ 101.35	5,300	\$ 159.80

Source: Daniel Stynes, Ph.D. & Dennis Propst, Ph.D., Michigan State University, "Economic Impacts of Visitor Spending, by Parks"; NPS Money Generation Model 2 (MGM2), 2003.

Contributions to Local Economy from National Park Service Operations

The employment offered by the National Park Service also contributes to the local economy. The social and economic benefits of this job base are two-fold. First, the jobs made available by the park and its partners provide hundreds of Bay Area residents with a steady income that helps sustain their lives and those of their families. Secondly, similar to the economic effects of revenue generated by park and monument visitation (as previously explained), the income earned by park and partner employees also has direct and secondary effects on the local economy. These employees contribute to the local economy by spending the money they earn on goods and services in the community. This spending directly supports local businesses and their growth. The local communities also benefit directly via the sales tax generated by this spending. In addition, secondary economic benefits (i.e., the multiplier effect) are realized when this money eventually circulates further into the Bay Area economy and beyond.

Because NPS employees reside throughout the entire Bay Area, the economic effect of their earned salaries (and subsequent spending in their respective communities) extends throughout the area as well. The following table summarizes the job base provided by the National Park Service as well as the salary totals for these jobs. It also identifies where

NPS employees live, which hints at where the most direct contributions to the local economy occur.

Table 11: 2009 National Park Service Jobs and Salaries, By Location of Residence

Location of Golden Gate National Recreation Area Employee Residence	Jobs	Salary Totals
Marin County	88	\$6,354,302
San Francisco City & County	96	\$6,192,113
San Mateo County	33	\$2,031,223
Other Bay Area Counties	116	\$7,755,854
Beyond Bay Area in California	8	\$465,400
Totals	341	\$22,798,892

Source: Golden Gate National Recreation Area, National Park Service, 2009.

As highlighted in the above table, the operation of Golden Gate National Recreation Area and Muir Woods National Monument creates 341 NPS jobs. The salaries for these jobs total to \$22.8 million per year. Although each individual employee spends and saves their earned salary money according to their own personal standards, one can conclude that a large percentage of this \$22.8 million circulates back into the local economy via the purchase of goods and services. All but \$465,400 of this salary total goes to employees who reside and spend directly within the Bay Area. In addition, nearly two-thirds of the park employees reside in the three gateway counties (totaling to 217 jobs and \$14,577,638 in salary).

In addition to the employee salaries, the NPS operation also supports the local economy by contracting out services with private enterprises in the Bay Area. These government contracts help support other businesses and their employees, which also has secondary multiplier effects when this money circulates through the community. In the NPS fiscal year of 2008, the National Park Service spent \$14,807,075 on contracts with private entities.

Tourism Attraction that Complements San Francisco and Other Bay Area Sites

In addition to injecting money directly into the local economy and supporting other local institutions, Golden Gate National Recreation Area and Muir Woods National Monument also contribute to the economy by helping generate tourism to other Bay Area attractions. This economic value primarily applies to visitors who come from outside of the Bay Area. From a tourist perspective, the allure of visiting the Bay Area is notably enhanced by the many sites, amenities, and resources of the park and monument. When these

attractions are considered collectively with other Bay Area attractions, the Bay Area becomes a very appealing region to visit.

The value of this synergistic effect extends well beyond the state of California, and the nation. International tourism in the Bay Area is a strong and growing industry. In addition, Golden Gate National Recreation Area contributes to the Bay Area's international tourism draw. For example, nearly 25% of visitors to Alcatraz Island came from other countries (Manning et al. 2007). When combined with the Bay Area's other diverse attractions, the many sites and resources of Golden Gate National Recreation Area play an important role in sustaining and expanding this international tourism market.

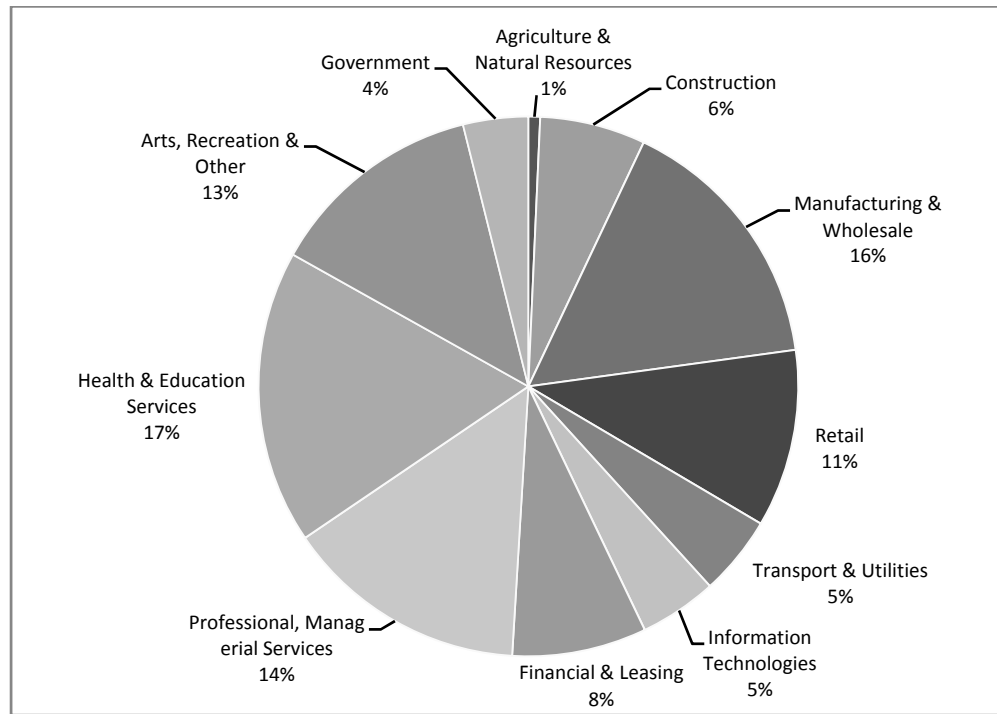
Bay Area Commerce and Industry Trends

As the Bay Area population has grown and diversified over the past 100 years, the local economy has also expanded and evolved. These changes have been brought on by local, state, national, and international attributes and events. For example, events such as World War II and the technology boom have played integral roles in the Bay Area's economic development. The Bay Area's economic history over the past 100 years can be defined by three general eras:

- **1900s to World War II** – This economic era can be described as being somewhat pastoral, with the local economy driven by industries such as seaport commerce, dairy farming, and fishing.
- **World War II era** – The Bay Area served as Central Command for the U.S. Army Pacific operations during WWII. As a result, the driving force on the local economy shifted toward military sea base and air base activities and manufacturing.
- **Post-World War II through late 20th century to present** – Over the past several decades, the Bay Area's economy has evolved, grown, and diversified considerably. The notable driving forces of the diversified economy include finance, education, local and regional tourism, health, arts, information technology, and expanding Asian markets.

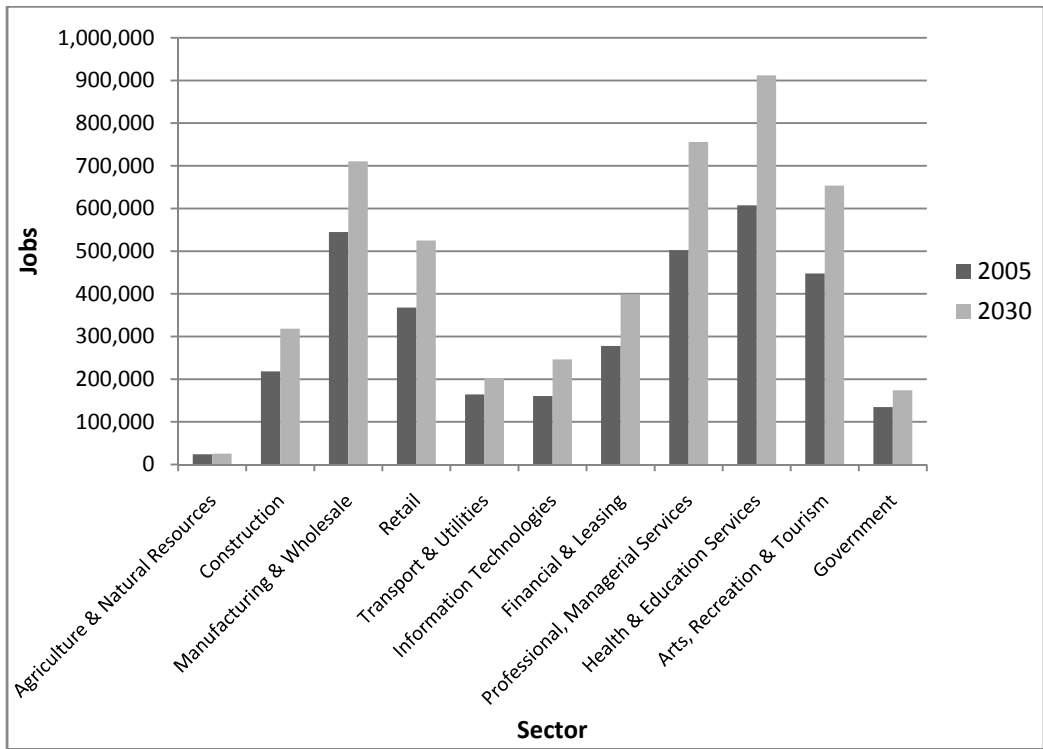
The following two graphs display the current and future projected distribution of jobs across various sectors or industries.

Figure 24: 2005 Bay Area Jobs, by Sector



Source: Association of Bay Area Governments (ABAG), "Projections 2007," 2007.

Figure 25: 2005 – 2030 Bay Area Employment Projections, by Sector



Source: Association of Bay Area Governments (ABAG), "Projections 2007," 2007

TRANSPORTATION (INCLUDING BOTH GOLDEN GATE NATIONAL RECREATION AREA AND MUIR WOODS NATIONAL MONUMENT)

This section summarizes existing transportation conditions for the planning area in Golden Gate National Recreational Area and Muir Woods National Monument. It addresses both internal circulation and access by all modes, including automobile, public transportation, bicycle, and pedestrian. Descriptions of conditions for Golden Gate National Recreation Area park sites are grouped by county (Marin, San Francisco, and San Mateo), with the exception of two park sites, Alcatraz Island and Muir Woods National Monument, which are addressed separately.

Analysis was conducted using a range of available materials, most of which are referenced directly within the text. Primary sources included the Phase 1 Transportation Analysis developed for this general management plan, for which a database incorporating information from close to 100 sources was developed by Golden Gate National Recreational Area staff. Raw data on transportation conditions collected in recent years were provided to the authors by Golden Gate National Recreation Area staff. Additional sources, such as California Department of Transportation traffic counts, were also used.

REGIONAL TRANSPORTATION CONTEXT

Existing and Projected Travel Demand

The Golden Gate National Recreation Area is located within the San Francisco Bay Area, a metropolitan region of approximately 7 million residents. In the counties surrounding the Bay Area, there are another 3.9 million residents (U.S. Census Bureau 2009). In all, close to 11 million people live within roughly a two-hour drive of Golden Gate National Recreation Area park sites.

This urban context, along with their popularity among tourists, places heavy demands on park sites. In 2007, Golden Gate National Recreation Area experienced total visitation of 20.8 million. While park sites in San Francisco are generally accessible to motorists, transit users, cyclists, and pedestrians, roads to and within many park sites in Marin and San Mateo counties are winding and narrow; both parking and public transit are limited in many places. These locations can “feel” remote during nonpeak periods despite their relative proximity to millions of residents; they are served by rural roads that were not designed to accommodate the level of traffic demand of major destinations, such as a national park. On busy summer weekends, two-lane roads leading to popular park sites can become severely congested.

Already, the Bay Area is America’s second most-congested metropolitan region, behind only Los Angeles (Schrank and Lomax 2007), with an average yearly delay per motorist caused by congestion of 60 hours. By 2030, the population of the Bay Area is expected to grow to 8.7 million, and the surrounding counties are projected to reach 5.7 million, resulting in a total population within a two-hour drive of Golden Gate National

Recreation Area park sites of approximately 14.4 million. The total number of vehicle miles traveled in the Bay Area on an average weekday is projected to increase from approximately 136 million in 2006 to as much as 179 million by 2035 (Metropolitan Transportation Commission 2008). Still, residents of the San Francisco-Oakland urbanized area take more trips, per capita, on public transportation than do residents of any other U.S. urbanized area except New York: about 130 per year, on average (American Public Transportation Association 2008).

Regional Transportation Policy

In order to accommodate population growth without compromising the regional environment or economy, Bay Area policymakers have increasingly sought to steer development and transportation trends in more sustainable directions. In its introduction to the *Transportation 2035 Plan for the San Francisco Bay Area*, the Metropolitan Transportation Commission, stated that:

“By means of its investment choices and adopted policies, the Draft Transportation 2035 Plan aims to stimulate the use of public transit, increase the safety, utility and appeal of bicycling and walking, and reduce emissions by private automobiles in the Bay Area while increasing the efficiency of the roadway systems for all users.”

While the Metropolitan Transportation Commission—through the regional transportation plan and related Transportation Improvement Program—sets funding priorities regionally, most transportation planning decisions in the Bay Area are made either at the county level by congestion management agencies or by transit agencies as part of their short range transit plans. Regional and local transit agencies are identified on the following pages. Congestion management agencies in counties with Golden Gate National Recreation Area park sites include the Transportation Authority of Marin, San Francisco County Transportation Authority, and City/County Association of Governments of San Mateo County. Marin, San Francisco, and San Mateo are all “self-help” counties under California law, meaning that voters have approved local sales taxes devoted to transportation.

Regional Transportation Network

The Bay Area is home to one of the nation’s most expansive highway systems. The regional transit network is less developed, although regional rail systems and ferry routes provide access to some Golden Gate National Recreation Area park sites via local rail and feeder bus connections.

Three major highways provide primary access to Golden Gate National Recreation Area park sites:

- *Highway 101*, which is a freeway in Marin and San Mateo counties and southern San Francisco and an arterial surface route in northern San Francisco, provides access to park sites in all three counties.
- *State Route 1*, which transitions from a two-lane highway in Marin County to an urban arterial in San Francisco and a freeway in northern San Mateo County before returning to a two-lane highway in southern San Mateo County, also provides access to park sites in all three counties.

Note: While many segments of this road have local names (e.g., Shoreline Highway, 19th Avenue, Pacific Coast Highway), throughout this document it is referred to as State Route 1.

- *Interstate 280*, a freeway, provides access to Golden Gate National Recreation Area park sites in San Francisco and in San Mateo County.

Two regional railways and several ferry routes provide transit access to Golden Gate National Recreation Area park sites:

- *Bay Area Rapid Transit*, or BART, is a metro system serving San Francisco, Alameda, and Contra Costa counties, as well as northern San Mateo County. From BART stations in San Francisco and San Mateo counties, local transit service is available to park sites in San Mateo, San Francisco, and Marin counties.
- *Caltrain* is a 77-mile-long commuter rail line operating from Santa Clara County through eastern San Mateo County to San Francisco. Local buses provide connections from Caltrain stations to park sites in San Mateo, San Francisco, and Marin counties.
- *Ferry* service is provided by the Golden Gate Bridge, Highway & Transportation District as Golden Gate Ferry, and by a private operator, Blue & Gold Fleet. At Sausalito in Marin County and in San Francisco, ferry service provides connections to transit or bike routes that can then be used to reach Golden Gate National Recreation Area park sites. Ferries also provide the only public access to Alcatraz Island. The 2007 *Golden Gate National Recreation Area Water Shuttle Access Study & Conceptual Plan* proposed additional ferry service to three Golden Gate National Recreation Area park sites: Fort Baker, Fort Mason, and the Presidio/Crissy Field in San Francisco.

“Transbay” buses operated by the East Bay’s AC Transit also connect to San Francisco Municipal Railway (MUNI) routes serving Golden Gate National Recreation Area park sites at San Francisco’s Transbay Transit Center. While most Transbay routes are commuter-oriented—offering the greatest amount of service during weekday morning and evening commuting periods—a few provide midday and weekend service.

Summary

In general, the Bay Area transportation network is oriented toward commuters; access to Golden Gate National Recreation Area park sites, which are generally relatively remote, is limited. In San Francisco, park destinations are closer to the community and well-served by transit. Even there, however, many Golden Gate National Recreation Area park sites are on the city’s west side, some distance from regional road and public transit networks. Transit access to park sites in Marin and San Mateo counties is especially limited. Demand exists for expanded transit options.

PARK TRANSPORTATION NETWORK

In this section, transportation conditions are first described for the two most-visited park sites in the planning area, Muir Woods National Monument and Alcatraz Island. Then conditions are described for park sites in each county: Marin, San Francisco, and San Mateo. Within each section, conditions are first summarized, then described by mode. Conditions are analyzed both in terms of access to park sites and internal circulation. Detailed maps of each county's transportation network can be found at the end of the transportation discussion.

Muir Woods National Monument

Muir Woods National Monument is a fee site, where an entrance fee is collected, and is a major tourist destination with an annual visitation of more than 800,000. For visitors accessing the site from Highway 101, the trip requires travel on almost 10 miles of winding two-lane county and state roads. Traffic on the two-lane roads leading to the site is often congested, especially at intersections of State Route 1 (Shoreline Highway). In addition, parking lots regularly fill by noon on busy summer weekends. Private tour buses serve Muir Woods National Monument year round. With the exception of summer and "shoulder season" weekends, there is no public transit service. Bicycle and pedestrian access to the remote canyon site is arduous. Parking at the site is especially problematic; on busy days, more cars are parked informally along roadside shoulders than in the designated lots, resulting in traffic congestion near the park entrance and conflicts between autos and pedestrians.

Traffic and Parking

Auto access to Muir Woods National Monument is along a narrow, twisting route that approaches from the east by way of a steep descent (with an average grade of more than 8%).

Traffic congestion along State Route 1 (Shoreline Highway) approaching the monument can be severe during peak periods, as noted previously. In the 2004 report from HDR, Inc. *Transportation Planning to Address Access and Congestion Issues – Muir Woods National Monument*, traffic studies indicated a peak season intersection level of service (LOS) of "F," where State Route 1 intersects with Tennessee Valley Road and Flamingo Road; and a LOS of "D" where State Route 1 intersects Muir Woods Road and Panoramic Highway. "F" is the lowest level of service, indicating average delay per vehicle of more than 50 seconds. The *Comprehensive Transportation Management Plan* also reported an accident rate along Panoramic Highway, a two-lane but relatively direct route along the spine of Dias Ridge between State Route 1 and Muir Woods Road, that was 140% higher than the statewide average for similar roads (Robert Peccia & Associates 2004).

It is estimated that even on summer weekends when Muir Woods Shuttle service is available, more than 60% of Muir Woods National Monument visitors arrive by private automobile (Nelson\Nygaard Consulting Associates 2008). Golden Gate National Recreation Area has estimated average vehicle occupancy of 2.5 persons, meaning that close to 1,200 autos might arrive at the National Monument over the course of a busy day. In 2004, as many as 2,855 cars were counted on Upper Muir Woods Road in a single

day, suggesting that the actual number of cars arriving at the National Monument on a busy day might be even higher. Also in 2004, up to 344 cars were observed arriving at the monument in a single hour (Robert Peccia & Associates 2004).

There are no current mode share data indicating how many visitors reach Muir Woods National Monument by tour bus, bicycle, or hiking.

This traffic results not only in congestion on roads approaching the national monument, but in congestion in the main and satellite parking lots, as cars circle in search of parking. It also results in congestion and auto-pedestrian conflicts along Muir Woods Road just west of the monument—where overflow parking is accommodated along the shoulder and pedestrians must at some points walk in the roadway. Officially, there are 179 parking spaces at Muir Woods National Monument in the main and satellite lots, and approximately 175 additional spaces that are considered legal along Muir Woods Road; the total then is approximately 350 parking spaces. However, up to 475 cars have been observed parked along the road near the monument at one time (Robert Peccia & Associates 2004). This is possible because motorists will park along the shoulder of Muir Woods Road up to a mile from the monument entrance, and walk along or in the road to the trail that leads to the entrance.

Transit

Muir Woods Shuttle. Established in 2005 as a pilot program, the Muir Woods Shuttle is now funded on an annual basis by Golden Gate National Recreation Area and the Marin County Transit District, or Marin Transit.

The shuttle is a seasonal service, operating on weekends during the five months from May through September. From Memorial Day weekend to Labor Day weekend, it consists of two routes:

- A Marin City to Muir Woods National Monument route operating on 20-minute headways from the Golden Gate Transit hub at Marin City (where connections can be made to buses from San Francisco) to the monument. This route also stops at satellite parking lots near the junction of Highways 101 and State Route 1 (approximately 9 miles from the monument).
- A Sausalito to Muir Woods National Monument route timed to connect with Golden Gate Ferry service from San Francisco at Sausalito (this route also serves Marin City and the Highway 101 / State Route 1 junction)

During the “shoulder season,” there is no Sausalito service, and the Marin City route operates on 30-minute headways.

Much of the shuttle’s ridership consists of motorists who, informed by changeable message signs on Highway 101 that the monument parking lots are full, follow instructions to exit at State Route 1, park, and take the shuttle instead. The service has proved to be extremely successful, currently providing 35,000 trips on weekends and holidays during the May to September season. The farebox recovery rate is 22%, comparable to many urban transit services) and ridership has grown from just a little more than 10,000 in its first year, even as the formerly free service has increased fares to \$3. Close to 10% of summer weekend visitors to the park now arrive by shuttle, and in

2008, it averaged 18.9 passengers per hour, higher than many suburban bus routes (Nelson\Nygaard Consulting Associates 2008).

The Muir Woods Shuttle has eased pressure on the overburdened parking areas at the monument and on the roads leading to the site. In addition, by connecting to regional transit services, it has greatly expanded non-automobile access for visitor to the park. Moreover, surveys of shuttle riders and other park visitors indicate that significant demand may exist for direct service between San Francisco and the monument; while relatively expensive to operate, this would serve to further reduce demand for automobile access to the monument.

Tour Bus. While no data is available on private tour bus operators serving Golden Gate National Recreation Area park sites, park staff estimate that up to 20% of visitors to the monument may arrive by tour bus. Twelve to fourteen spaces in the lower parking lot are reserved for tour buses, and multiple operators provide tours, typically departing from San Francisco and including a stop in Sausalito.

Bicycle and Pedestrian

Bicycle access to Muir Woods National Monument is poor. State Route 1 and Muir Beach Road are narrow, winding two-lane roads and lack bike lanes and shoulders for much of their length, although bicycle parking is provided. Pedestrian access is also poor, limited to trail connections that converge at the monument (including the popular Dipsea Trail, which connects the monument to the town of Mill Valley 3 miles away, and to Stinson Beach to the west).

Summary

Muir Woods National Monument is accessed primarily by automobile or tour bus, although public transit service is available on summer and “shoulder season” weekends. Cyclists and pedestrians must bike or hike long distances to reach the remote site, although trails to and within the monument are very good. Parking at the monument is limited and not well-configured—overflow parking along the shoulders of a narrow road is common—and this results both in congestion and in conflicts between traffic and pedestrians.

Alcatraz Island

With approximately 1.4 million annual visitors, Alcatraz Island is Golden Gate National Recreation Area’s most visited site. Alcatraz is an island in San Francisco Bay; while admission to the park itself is free, the only access to the island is a 15-minute trip by ferry at a cost of \$26 per person (2009). Ferries depart from a landing near Fisherman’s Wharf in San Francisco, which is relatively accessible by all modes of transportation.

Traffic and Parking

Automobile access to the Alcatraz Island ferry landing at Pier 33, just southeast of Fisherman’s Wharf, is generally good. The site is immediately adjacent to the Embarcadero, a six-lane boulevard connecting directly to the San Francisco-Oakland Bay Bridge (Interstate 80) and Interstate 280, and indirectly to Highway 101. Pier 33 is also near Bay Street, a four-lane city street connecting to Highway 101 and the Golden Gate Bridge. However, all of these routes can become congested during peak hours.

Parking near the Alcatraz Island ferry landing at Pier 33 is fee parking, and much of it consists of on-street meters with time limits of two hours or less. However, several large parking garages are located nearby.

Public Transit

Ferry service to Alcatraz Island currently departs from Pier 33. Service is provided by Alcatraz Cruises, a park concessioner, and operates as often as every 30 minutes. Other ferry operators also offer Bay tours that pass by Alcatraz Island and other Golden Gate National Recreation Area waterfront park sites. A number of public transportation options within San Francisco provide visitors with good access to Pier 33.

Bicycle and Pedestrian

Pier 33 is easily accessible by bicycle, and several bicycle rental companies are located nearby. Bicycles are not allowed aboard Alcatraz Island ferries, but limited bicycle parking is available at Pier 33 on a first-come, first-served basis.

Likewise, pedestrian access is good. From the south, a broad promenade runs alongside the Embarcadero, and San Francisco city streets to the west generally feature spacious sidewalks.

Summary

Alcatraz Island can be accessed only by ferry from San Francisco, although access to the ferry landing is good for all modes of transportation. While parking is available for a fee, there is on-street metered parking and several large garages nearby. public transit access is excellent, and bicycle and pedestrian access over San Francisco city streets is likewise very good.

Marin County Park Lands

Golden Gate National Recreation Area park sites within Marin County are generally distinct in character from those in San Francisco and San Mateo counties. As Marin County park sites are located within western Marin County, many are some distance from the county's developed eastern corridor. Due to this isolation, Golden Gate National Recreation Area park sites in Marin County are accessed primarily by automobile, although limited public transit service is available, and many recreational cyclists ride long distances to access them. In addition, there are directional and park identity signs both within the park lands and on roads leading to them that are generally clear and highly visible; there is also limited water access for private boats to Fort Baker through a marina.

The relative remoteness of Golden Gate National Recreation Area park sites within Marin County contributes to their popularity with both residents and tourists. However, it also results in severe congestion at the most accessible sites during peak periods, both on roads leading to the park sites and around parking areas. Congestion is compounded by insufficient parking and conflicts between automobile and pedestrians, who often must walk in or alongside roadways due to a lack of infrastructure—including both sidewalks and trails paralleling roadways—at popular destinations (such as Tennessee Valley).

Means of visitor access to the Marin Headlands were sampled on Fridays, Saturdays, and Sundays in the summer of 2000 and spring of 2001. The survey showed that 91% arrived

by private automobile, 4.7% by bicycle, 4% by bus (including public transit as well as private, chartered, and school buses), while just 0.2% arrived on foot (NPS 2009a).

Traffic and Parking

Many visitors to Marin County Golden Gate National Recreation Area park sites arrive in the county by driving over the Golden Gate or Richmond-San Rafael bridges, and even residents of Marin County use Highway 101 for parts of their trips. Once motorists have exited Highway 101, however, access to many Golden Gate National Recreation Area park sites requires steep, winding drives on narrow rural roads.

Average volumes of traffic on these roads do not necessarily suggest congestion, and outside of the busiest peak periods, there is little congestion on roads leading to or within Golden Gate National Recreation Area park sites in Marin County. Traffic studies conducted in October and November of 2009 show LOS A and B on State Route 1 (Shoreline Highway) between Highway 101 and Northern Avenue. However, traffic increases significantly on summer and holiday weekends. Annual average daily traffic on State Route 1 in the area of Stinson Beach, for example, is just 4,100 vehicles per day, and peak hour traffic is 420 cars per hour, or 7 vehicles per minute in both directions combined (California Department of Transportation 2009). Yet, the number of cars at the entrance to Stinson Beach reached 39,709 in July 2007, 455% higher than in January, and in 2004, counts reached 4,451 in a single summer day (Nonmotorized Transportation Pilot Program 2005). Even greater monthly traffic has been observed along Conzelman Road in the Marin Headlands, where 80,300 vehicles were recorded at a point in the Rodeo Valley in the month of September 2007. In 2000, traffic counts on roads entering and exiting the Marin Headlands near the northern end of the Golden Gate Bridge found combined traffic on summer weekends of approximately 10,200 vehicles, with about two-thirds on Conzelman Road and the remainder on Bunker Road. Summer 2000 weekend traffic on Alexander Avenue (which is just outside the Marin Headlands, and thus not maintained by the National Park Service), connecting the Golden Gate Bridge to Sausalito and providing access to the Marin Headlands and Fort Baker, was approximately 11,300 vehicles (NPS 2009a).

Roads within the park lands of Marin County managed by the National Park Service are often in a poor state of repair. A 1999 survey of pavement conditions within the Marin Headlands and Fort Baker found fully two-thirds of roads to be in poor condition (NPS 2009a). Conditions have not changed significantly since then, although all 18 miles of NPS roads in the Marin Headlands and Fort Baker are programmed for rehabilitation beginning in 2010.

The greatest traffic congestion within Golden Gate National Recreation Area park sites appears to occur immediately around parking areas at popular destinations. Whether they consist of large lots or informal, roadside parking along shoulders, cars pulling into or out of parking areas and pedestrians traveling to or from their cars can create congestion and unsafe conditions along narrow roads.

This congestion is a result of demand exceeding supply, with undesirable shoulder parking as a result. At the Tennessee Valley trailhead, where there are 86 formal parking spaces, the *Comprehensive Transportation Management Plan* reported maximum occupancy, including cars parked alongside Tennessee Valley Road, of 202 vehicles or 235% of capacity. Parking lots at Stinson Beach (124%) and Muir Beach (107%) were

also found to be filled beyond capacity (Robert Peccia & Associates 2004). The *Marin Headlands / Fort Baker Transportation Plan*, meanwhile, reported up to 35 cars parked at Battery Mendell in the Marin Headlands, in an area with a capacity of 30, and 24 cars were in 24 spaces at Battery Spencer, where, as at Muir Woods National Monument, cars, buses and pedestrians come into conflict when there is parking along a narrow road (NPS 2009a). Although all Golden Gate National Recreation Area parking within the plan area is currently free, approved plans will introduce fee parking in the Marin Headlands and at Fort Baker.

Public Transit

Public transportation access to Marin County Golden Gate National Recreation Area park sites is limited. Most destinations within the park lands are inaccessible via transit without significant hiking or biking from the closest transit stops, although a few park sites are served directly or indirectly by infrequent, weekend-only, or seasonal bus routes. Most of those routes serve a limited area, although connections can be made to regional services in eastern Marin County and San Francisco. Three public transit agencies provide some form of service to Golden Gate National Recreation Area park sites, while a seasonal shuttle service to Muir Woods National Monument is operated jointly by the National Park Service and a local transit provider. In general, transit service in Marin County is either oriented toward commuters (Golden Gate Transit) or those taking local trips (Marin Transit), or serves Golden Gate National Recreation Area park sites but only on a limited basis (West Marin Stagecoach). More information on public transit services to Marin County Golden Gate National Recreation Area park sites can be found in appendix E.

While no data is available on private tour bus operators serving Golden Gate National Recreation Area park sites, park staff believes that up to 20% of visitors to Muir Woods National Monument may arrive by tour bus. Twelve to fourteen spaces in the lower parking lot are reserved for tour buses, and multiple operators provide tours, typically departing from San Francisco and including a stop in Sausalito. Tour bus use is also common (if accounting for a relatively small mode share) in the Marin Headlands and Fort Baker.

Bicycle

Western Marin County is a popular destination for recreational cyclists. Despite blind curves and heavy traffic, road cyclists seeking a challenge are a common sight on its steep, narrow roads, while mountain biking remains popular on fire roads and trails throughout Marin County, the birthplace of the sport. Many San Francisco visitors rent bicycles and ride them over the Golden Gate Bridge making the return trip via ferry from Sausalito. Alexander Avenue between Sausalito and the Bridge, which is a regional road administered by the Golden Gate Bridge District, is a popular route for cyclists (although it lacks a complete bike lane, and is confusing and potentially unsafe for novice cyclists).

On May 11, 2008, a sunny Sunday, Golden Gate National Recreation Area counted 1,432 cyclists northbound on Alexander at Bunker Road, above Fort Baker.

Although amenities for cyclists are currently limited, there is bicycle parking at Battery Spencer. As part of the *Marin Headlands & Fort Baker Transportation Infrastructure & Management Plan* (2009), a number of improvements for bicyclists are being made. These include roadway improvements to enhance bicycle safety, a new bicycle and

pedestrian path between the Marin Headlands and Fort Baker, new trail access, and an uphill bicycle lane on Conzelman Road from Alexander Avenue to McCullough Road.

Pedestrian

The key issue for pedestrians at Marin County park sites is conflicts with automobiles near congested parking areas; this issue was described at length in the previous sections on Marin County Traffic and Parking. Remaining pedestrian issues are addressed below.

Golden Gate National Recreation Area park sites in Marin County are generally relatively remote. Muir Beach and Stinson Beach are 6 to 12 miles from the Highway 101 corridor, and are adjacent to small communities that are surrounded by park land, while the eastern edge of the park lands in the county's southwestern corner is bordered by the larger communities of Marin City, Tamalpais Junction, and Mill Valley. Despite several trails that extend into these communities, pedestrian access to park sites is fairly limited. Even in those residential areas adjacent to park lands, there are few sidewalks, and residents of southern Marin County often drive to nearby trailheads, such as Tennessee Valley. Tourists sometimes walk over the Golden Gate Bridge from San Francisco into Marin County, but are not likely to ascend into the Marin Headlands farther than Battery Spencer, which is a short distance beyond the northern end of the Bridge.

However, Golden Gate National Recreation Area park sites in Marin County feature an extensive network of fire roads and trails of all types. Trail connectivity is good, both within Golden Gate National Recreation Area park sites and to trails extending into adjacent park lands such as Mount Tamalpais State Park. Coverage is dense in the southern park lands, extending from Muir Beach into Tennessee Valley and the Marin Headlands. While many trails within Marin County park sites are multiuse, bikes, dogs, or horses are not allowed on some trails.

Summary

Marin County park sites are accessed primarily by private automobile. The most popular destinations experience considerable congestion during peak periods on winding, two-lane roads and exceed the capacity of limited parking areas. There is little public transit service to park sites within Marin County. While bicycle access can be challenging due to topography and narrow roadways, these park lands are popular destinations for recreational cyclists. There is little pedestrian access to the park sites, but hiking is a popular activity within them.

San Francisco Park Lands

Golden Gate National Recreation Area park lands in San Francisco are generally immediately adjacent to urban neighborhoods. As a result, San Francisco park sites are distinct: they are much more multimodal in terms of both access and circulation than are park sites in Marin and San Mateo counties, which are strongly oriented toward the automobile. Pedestrian, bicycle, and public transit access is generally very good. One site—Ocean Beach—is directly served by two rail transit lines. The park sites include large parking lots. Signage is good within park sites, although trails to park sites from the city are not always well marked.

Traffic and Parking

Automobile access to Golden Gate National Recreation Area park sites in San Francisco is generally good. While access to most park sites requires travel over San Francisco city streets—some of which can be quite congested during commuting hours—multiple access routes are available, and there are sizable parking lots available at almost every location. These lots often become full at peak times.

Public Transit

In general, park sites in San Francisco enjoy the sort of frequent and extensive transit service that is rare in the national park system. All Golden Gate National Recreation Area park sites in San Francisco and the Alcatraz Island ferry are served at least indirectly by MUNI light rail, historic streetcar, cable car, or bus routes operating on headways of 20 minutes or less from early morning until late in the evening.

MUNI stops near Golden Gate National Recreation Area park sites, however, generally lack many amenities (including park-related signs or other wayfinding information). MUNI vehicles are often crowded, especially at commute times, with 4.3% of morning peak period trips exceeding 125% of seating and standing capacity (San Francisco Municipal Transportation Agency 2009). Details of MUNI routes serving Golden Gate National Recreation Area park sites can be found in appendix E.

A number of changes have been planned to MUNI service that would impact access to Golden Gate National Recreation Area park sites. Some reductions in service have been implemented in response to a budget issues, but improvements in service are also planned, such as the MUNI E-line extension. Other changes are detailed in appendix E.

Transit service to selected Golden Gate National Recreation Area park sites is also provided by the PresidioGO shuttle, operated by the Presidio Trust within the Presidio, with a downtown express shuttle connecting to regional transit, and by Golden Gate Transit from Marin County.

Bicycle

Bicycle access both to and within Golden Gate National Recreation Area park sites in San Francisco is good. Unlike in Marin and San Mateo counties, where steep grades and rough trail conditions make many routes accessible to only the most expert cyclist, San Francisco's bicycle system and the park sites offer opportunities for cyclists of all skill levels.

Designated bicycle routes, including on-street bike lanes and, in Golden Gate Park, off-street paths, connect to all Golden Gate National Recreation Area park sites in San Francisco. An off-street multiuse trail runs along the northern waterfront from Aquatic Park to the Warming Hut at Crissy Field; from there it is a short distance to the Golden Gate Bridge, which features a dedicated bike path on its west side connecting cyclists to Golden Gate National Recreation Area park sites in Marin County. Additional paths and lanes can be found within the Presidio, and there are several multiuse trails at Lands End. A bike path constituting a segment of the Pacific Coast Bicycle Route runs on city land along nearly the entire 3.5 mile length of Ocean Beach, and there are numerous paved multiuse trails within Fort Funston.

Pedestrian

The uniquely urban context of park sites within San Francisco results in much greater pedestrian access than can be enjoyed at park sites in Marin and San Mateo counties. Streets leading to park sites typically include sidewalks, and the only obstacles to pedestrian access are distance, busy streets, and hills in some locations. However, all Golden Gate National Recreation Area park sites are along the city's waterfront, and thus most are at a lower elevation than the majority of pedestrian trip origins.

There are, however, some obstacles to pedestrian access. Fort Funston in the city's southwestern corner is relatively isolated, located west of Lake Merced and across the Great Highway and Skyline Boulevard from city streets. Pedestrian access to Ocean Beach requires crossing the Great Highway at signalized pedestrian crosswalks over a four-lane highway. All of the park sites in San Francisco, however, are connected to each other by the Bay Trail and Coastal Trail, including segments that meet accessibility standards for people with disabilities.

Within park sites, pedestrian routes vary from sidewalks to paved paths, boardwalks, and unpaved trails. Accessibility for people with disabilities is much higher here than at park sites in Marin and San Mateo counties, where few paved, level paths exist.

Coastal Trail and Bay Trail improvements are planned as part of the Trails Forever Program, a collaborative effort of the Golden Gate National Parks Conservancy, the Presidio of San Francisco, and the park.

Summary

San Francisco park sites, uniquely situated within an urban environment, are generally connected to their surroundings by public transit and a network of streets, bike routes, and sidewalks. Parking is generally available, and there are extensive trail networks within the larger park area.

San Mateo County Park Lands

Just as Golden Gate National Recreation Area park sites in Marin County and in San Francisco share many characteristics in common that make them distinct from the park sites in other counties, park lands in San Mateo County are notable in a number of ways. They are generally less developed in terms of amenities, less used (although some park sites are popular with local residents), less connected to one another, and different in terms of their primary means of access. As in Marin County, private automobiles are the primary mode for access to Golden Gate National Recreation Area park sites in San Mateo County.

Directional and park identification signs, as well as parking at most park sites is limited, if they exist at all. The "typical" Golden Gate National Recreation Area site in San Mateo County consists of open space with trails of various qualities that are accessible from a trailhead, which either provides limited, informal parking, or no parking at all. Some park sites are relatively remote and inaccessible to pedestrians and transit users, while others are immediately adjacent to suburban neighborhoods and feature many "social" or informal entrances. Bicycle access is generally good, although some park sites do not accommodate cyclists and safer routes are needed along much of State Route 1 south of Pacifica.

Traffic and Parking

Auto access to San Mateo park sites is generally good, although parking at trailheads can be in short supply or available only on an “informal” basis on nearby streets; also some roadways experience congestion.

Highways 1 and 280 provide primary access to most park sites, along with Highway 35, or Skyline Boulevard, which is a suburban arterial in its northern segment, near Milagra Ridge, and a two-lane rural road in the south, near Phleger Estate. Highway 92, Sharp Park Road, and other rural and suburban roadways also provide access to Golden Gate National Recreation Area park sites. State Route 1 experiences relatively high volumes of traffic (California Department of Transportation 2009).

A segment of State Route 1 between Pacifica and Montara, called Devil’s Slide, has long been prone to landslides that have closed the road for periods of several months. This segment is now being replaced by an inland bypass including twin tunnels and bridges. These are due for completion in 2011. At that time, the existing segment of roadway will be converted to a multiuse California Coastal Trail segment extending north and south to connect to Golden Gate National Recreation Area and state park sites along the coastline.

Finally, data on parking demand is not available. However, at park sites in San Mateo County, parking is generally both limited and informal; in addition to trailhead lots at Milagra Ridge, Sheldance Nursery, and Sneath Lane, parking is found along roadsides, in neighborhoods, and in business parking lots.

At San Francisco Public Utility Commission (SFPUC) watershed trailheads, parking is likewise along roadsides. However, there are more than 40 spaces at the southern end of the popular Sawyer Camp Trail. At Rancho Corral de Tierra, parking is associated with the equestrian facilities.

There are several parking areas that serve to access the park at adjacent college or state park parking lots.

Access to Phleger Estate is generally through Huddart County Park, which provides adequate parking on most days.

Public Transit

The San Mateo County Transit District, or SamTrans, provides bus service throughout the county. As San Mateo is a relatively low-density, suburban county, much of this service is relatively infrequent, operating on headways of 30 minutes to as much as 180 minutes, and some routes do not operate on weekends or mid-days, outside of normal commuting hours. Stops generally lack amenities, and pedestrian routes from stops to Golden Gate National Recreation Area park sites often lack sidewalks and directional signs. However, as many park sites in San Mateo County are immediately adjacent to neighborhoods, a few stops are located within walking distance of Golden Gate National Recreation Area park sites. In general, SamTrans provides a fair level of service to Pacifica and Montara, including relatively frequent service to Mori Point and Milagra Ridge. Service to these two areas also connects to BART and operates seven days a week. Service to the Sawyer Camp and San Andreas trails, however, is limited to weekdays, and Phleger Estate is currently not served by transit. More information on SamTrans service can be found in appendix E.

Bicycle

Bicycle access to Golden Gate National Recreation Area park sites in San Mateo County is mixed; however, bicycle amenities within the park are generally good, as cyclists are allowed on most trails.

While most bicycle access is over roadways without separate bicycle facilities, a grade-separated, off-road bike path parallels State Route 1 along the Pacifica shoreline, connecting Pacifica State Beach just north of Pedro Point to Rockaway State Beach and Mori Point. Another unpaved path runs north from Mori Point to Sharp Park Beach, and there are bike lanes along Sharp Park Road connecting to Milagra Ridge. Cañada Road, running south from the SFPUC watershed, is closed to motor vehicles for several hours on county-sponsored “Bicycle Sundays.”

Milagra Ridge, meanwhile, features a paved loop within the site. The popular Sneath Lane Trail at Sweeney Ridge is paved, and the popular Sawyer Camp and San Andreas trails in the SFPUC watershed are primarily high capacity, paved, multiuse trails with median striping and mile markers. Bicycles are prohibited on trails within the Phleger Estate.

The *San Mateo County Bicycle Plan* proposes improvements to routes popular with cyclists, including Cañada Road, and while improvements are not planned, a route allowing bike access from the San Mateo County suburbs east of Interstate 280 to the road and mountain bike trails west of Skyline Boulevard has been identified as a priority for cyclists. This could require bicycle access in the vicinity of Phleger Estate.

At Rancho Corral de Tierra, several miles of existing trails are primarily multiuse, though mostly steep and unpaved. The northern area of Rancho Corral de Tierra is connected to McNee Ranch State Park, by Old Pedro Mountain Road, a multiuse county trail that continues north to Pacifica.

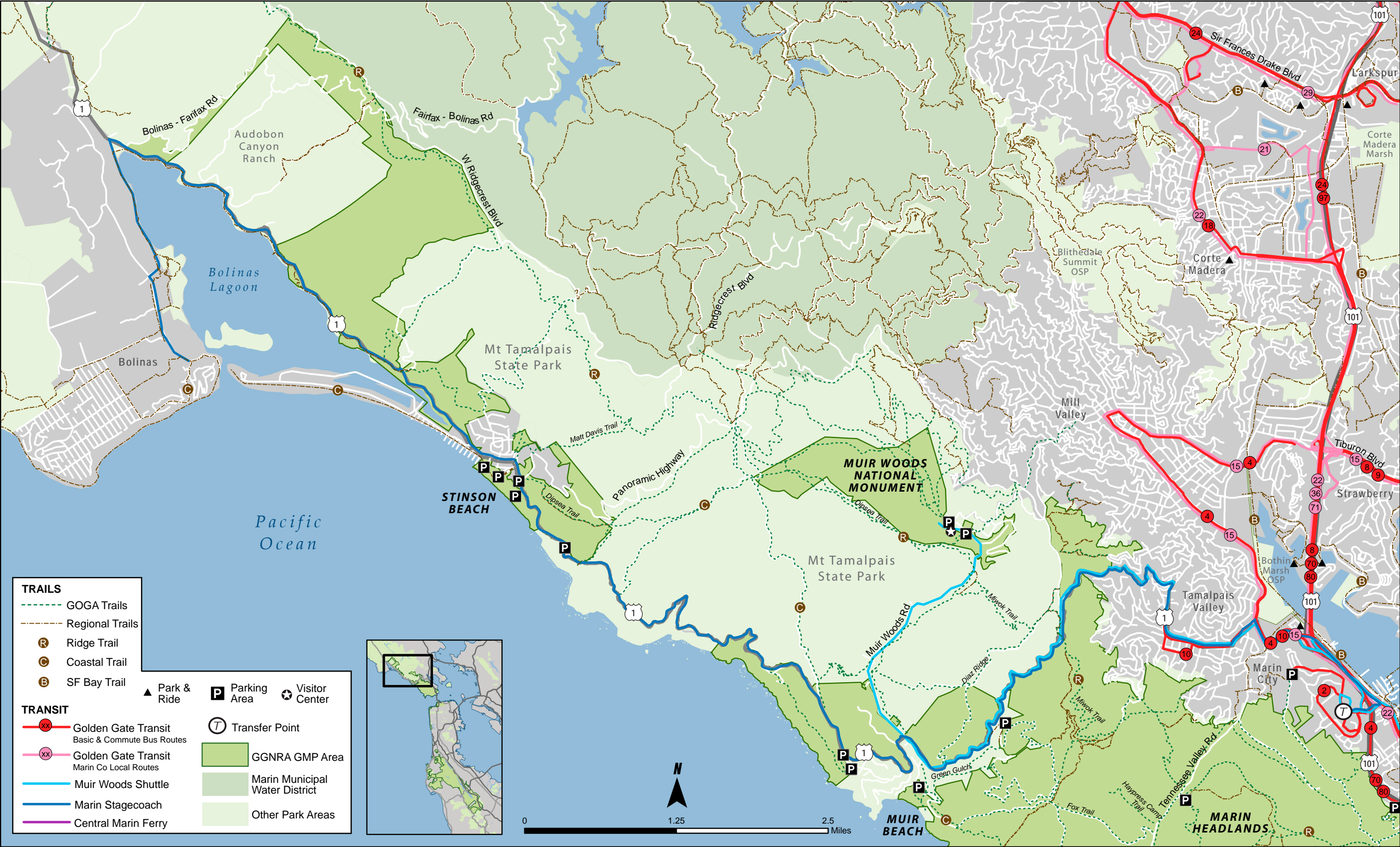
Pedestrian

Pedestrian access to Golden Gate National Recreation Area park sites in San Mateo County is limited. Trailheads at a few park sites, such as Milagra Ridge, Sweeney Ridge, Mori Point, Pedro Point, and Rancho Corral de Tierra, are adjacent to suburban neighborhoods and thus are relatively accessible to pedestrians (although sidewalks leading to the park sites are sometimes lacking). However, pedestrian circulation within San Mateo County park sites is in many cases very good, as most San Mateo County park sites are essentially open space preserves with trail networks. Also, two park sites, Rancho Corral de Tierra and Phleger Estate, offer extensive equestrian access. Trails within San Mateo County Golden Gate National Recreation Area park sites are detailed in appendix F.

Summary

San Mateo County park sites are generally adjacent to suburban developments and are easily accessible by automobile. However, they are not well served by public transit, which is oriented toward commuters. Bicycle access is generally good, and hiking is popular within the parks. While more discontinuous than park sites in Marin County or San Francisco, San Mateo County park sites are connected in part by both the California Coastal Trail and the Bay Area Ridge Trail. San Mateo park sites are also popular with equestrians, and there are many multiuse trails, with little conflict among users.

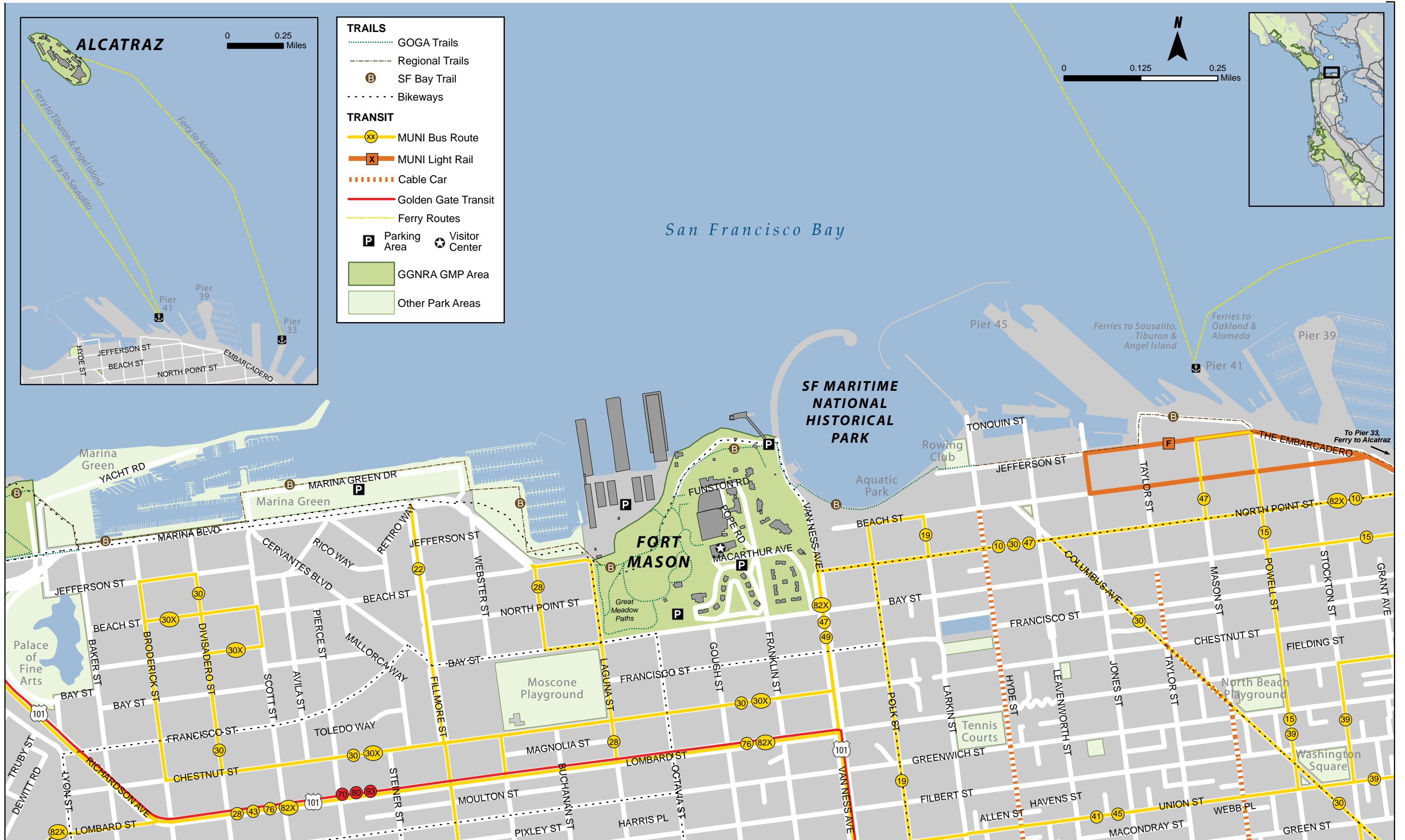
Marin County Transportation Network: Muir Woods, Stinson Beach



Marin County Transportation Network: Marin Headlands



San Francisco Transportation Network: Fort Mason, Alcatraz



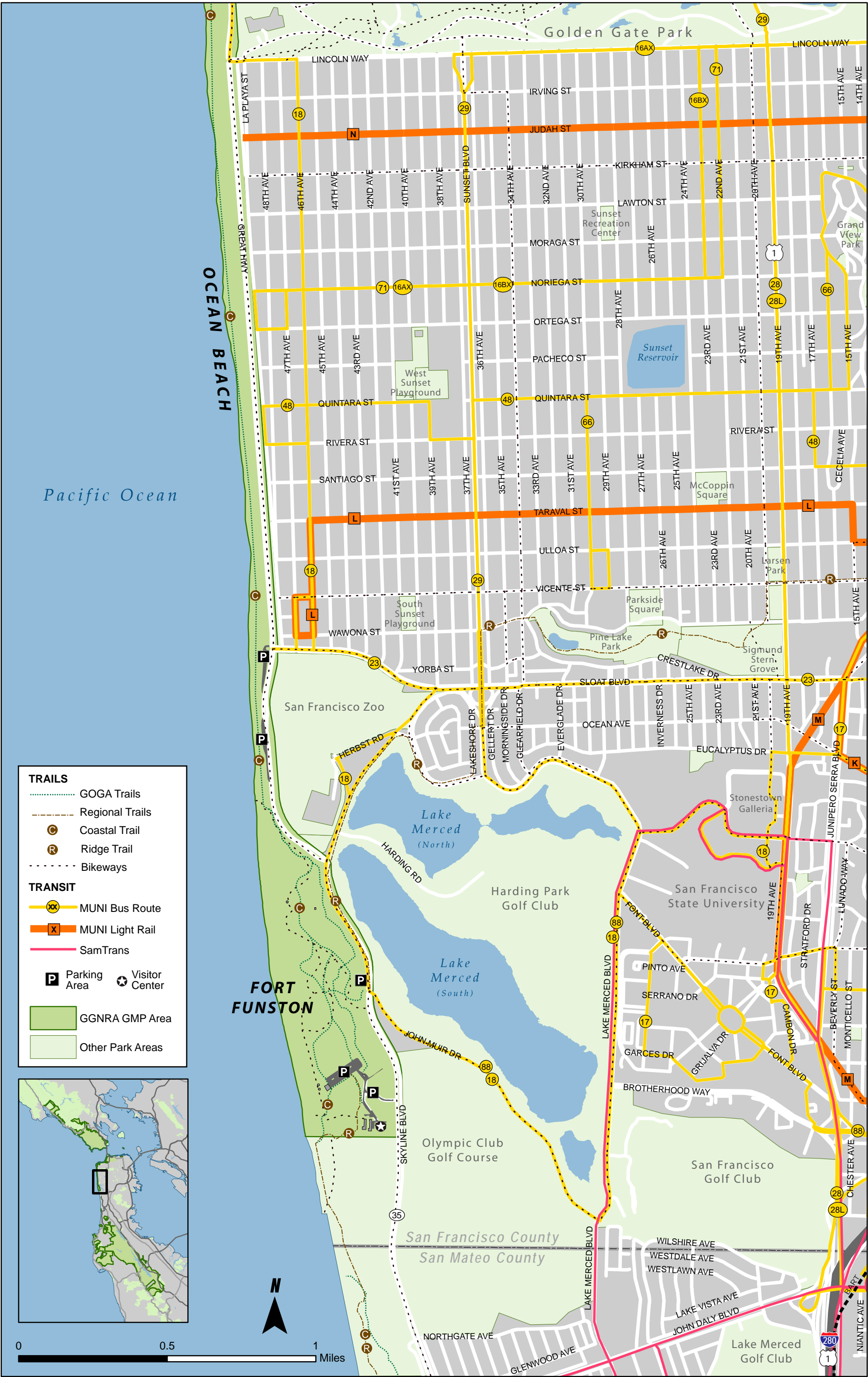
San Francisco Transportation Network: Baker Beach, Presidio, Crissy Field



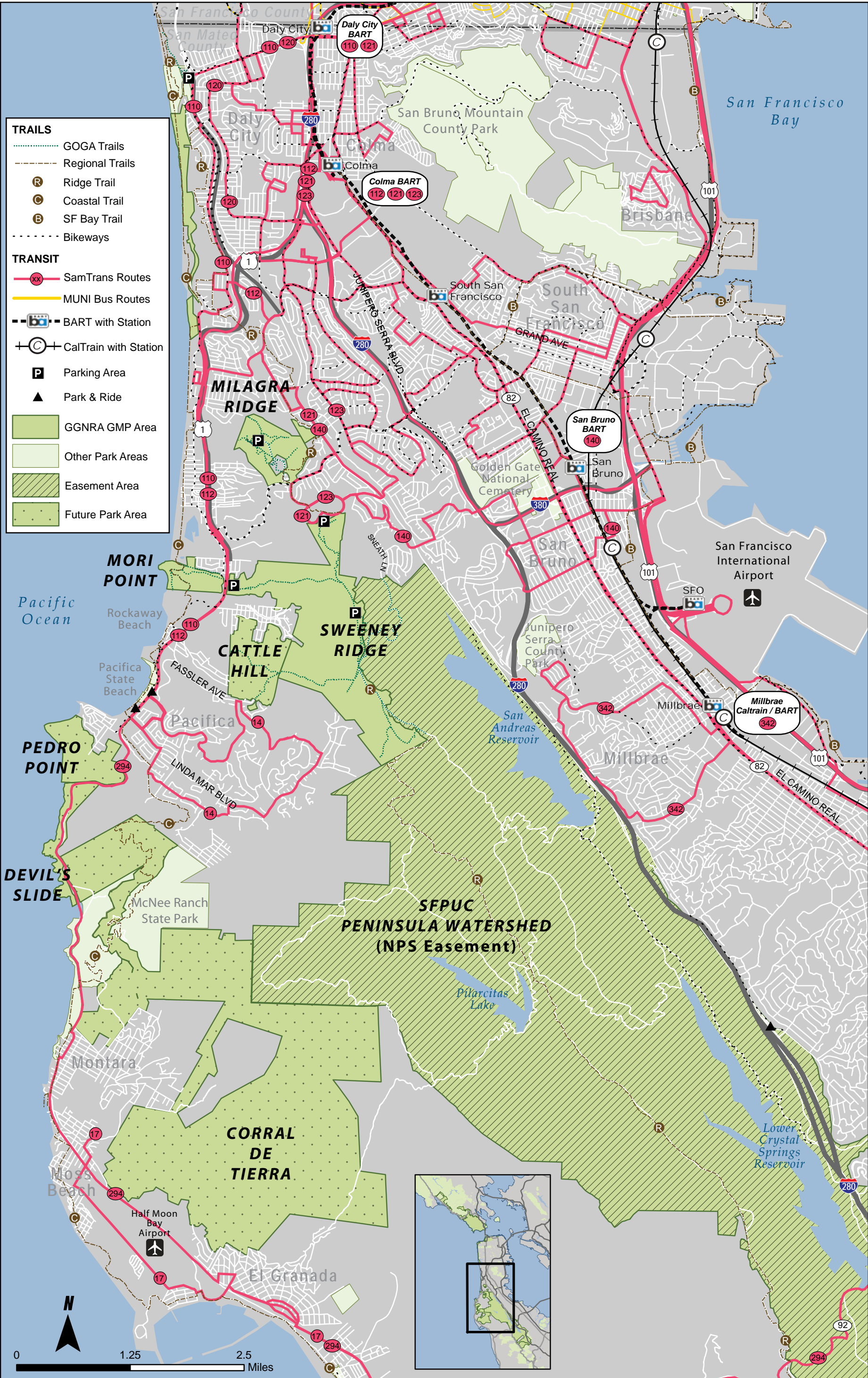
San Francisco Transportation Network: Lands End, Sutro Heights



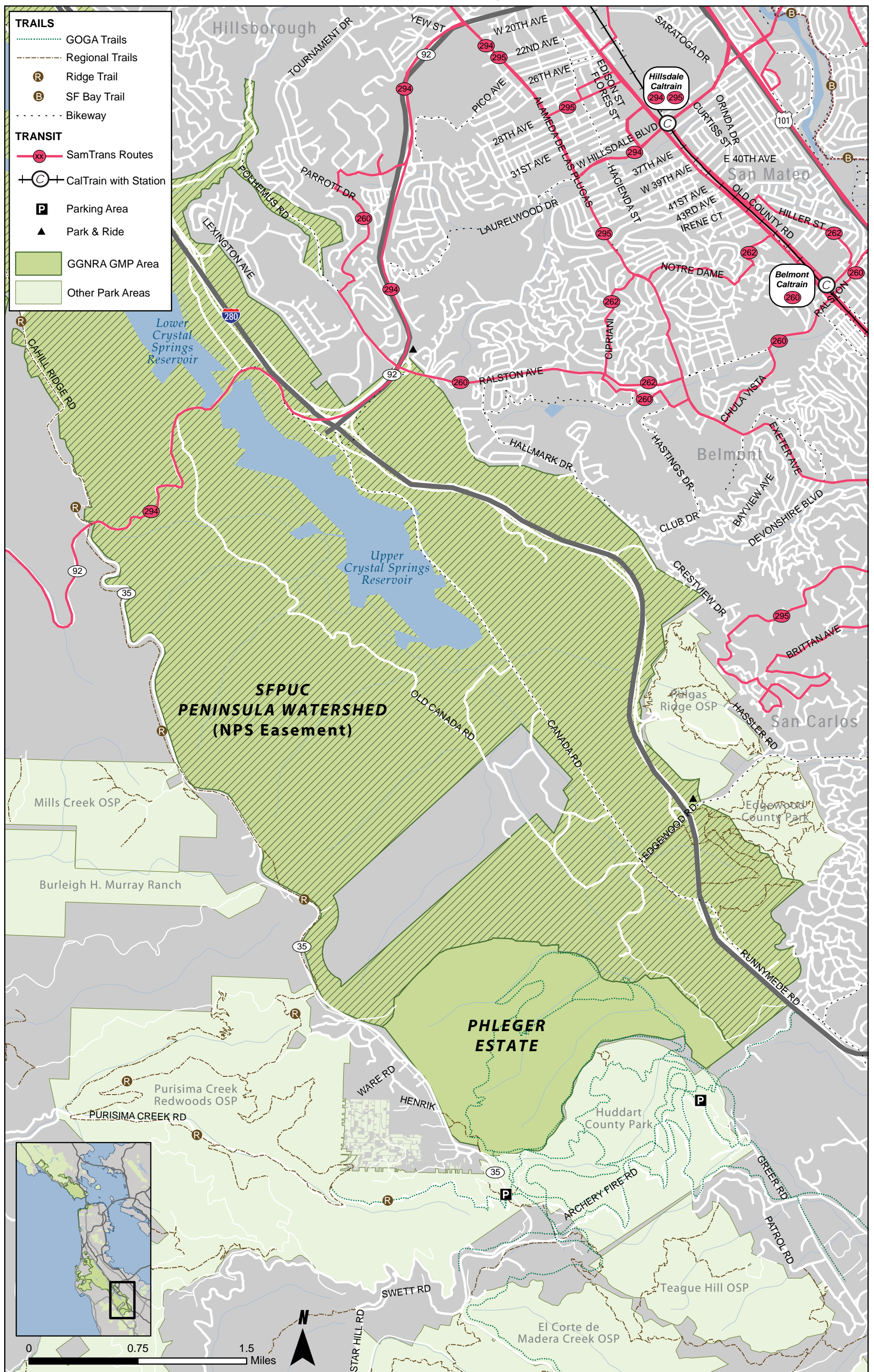
San Francisco Transportation Network: Ocean Beach, Fort Funston



San Mateo County Transportation Network: Northern San Mateo County



San Mateo County Transportation Network: Phleger Estate, SFPUC Watershed



PARK MANAGEMENT, OPERATIONS, AND FACILITIES (INCLUDING BOTH GOLDEN GATE NATIONAL RECREATION AREA AND MUIR WOODS NATIONAL MONUMENT)

STAFFING

The park management team and staff are responsible for both Golden Gate National Recreation Area and Muir Woods National Monument. In 2009, the park was staffed by 335 full-time-equivalent employees (FTEs), which includes full-time, part-time, term, temporary, and student employment. The NPS staff is supplemented by the staff of the Golden Gate National Parks Conservancy, numerous park partners, and a large number of volunteers who fulfill critical roles within the operations and programming of the park and monument.

Office of the Superintendent

The Office of the Superintendent includes managerial activities of the Superintendent, Deputy Superintendent, Public Affairs, and Strategic Planning and Initiatives, as well as administrative staffs. The Deputy Superintendent's Office is responsible for a considerable portion of the park management including staff in the areas of administration, business management, cultural resources and museum management, interpretation and education, environmental and safety, maintenance, natural resources management and science, planning and compliance, visitor resources and protection and administration.

Planning, Projects and Compliance

The Division of Planning is an assemblage of planning, environmental review, transportation, and design professionals who provide park management with the technical expertise and policy guidance needed to plan for preservation and protection of the park's natural and cultural resources, provide for appropriate public use, and manage public involvement in the planning and decision-making process. Planning staff work as a team with other park divisions, park partners, other agencies, and consultants to make this mission a reality.

Given the complexity of managing a large park unit adjacent to a high density, urban population, the project workload into the future is substantial. Adequate planning staff is critical for achieving the park's vision; maintaining positive relationships with the public; and meeting the high expectations set internally by the National Park Service and externally by the community. The park's ability to benefit from the philanthropic capacity of the Bay Area will continue to depend heavily on the park's ability to plan for and manage projects and programs funded by outside sources. Current funding provides about two-thirds of the needs for management and administration with the balance derived from external sources.

Cultural Resources and Museum Management Division

This division oversees management of more than 365 inventoried archeological sites, some of which predate European contact and constitute the most tangible connection between the Coast Miwok and Ohlone communities and park lands, and more than 700 historic structures, most of which related to military and maritime commercial themes stretching over a period of more than 200 years. The park includes 5 national historic landmarks, 12 properties listed in the National Register of Historic Places, and 7 properties determined eligible for national register listing; 9 documented cultural landscapes, including rural landscapes and dairy ranches; and 4.2 million items in museum collections. The staff for this division includes authorization for 16 FTEs, however, 4 key positions (3 Historical and Landscape Architects and 1 Compliance Assistant) are term appointments and dependent on funding levels. The division is working toward documenting baseline conditions of all park resources in an effort to guide future operations and programs. Volunteers are necessary to support the park staff, given the large number, diversity, and significance of the park's cultural resources.

Environmental and Safety Division

This group is responsible for environmental protection and occupational health and safety; the staff consists of 1% of the total park workforce. The division manages the park's sustainability programs and is central to addressing climate change. Minimizing the park's environmental impact and movement towards being climate neutral are core responsibilities of the division. The group also manages comprehensive water and energy conservation programs, reduced fossil fuel consumption, sustainable waste management, hazardous and universal waste management, air permits, hazardous materials, and hazardous waste remediation projects.

Facility Operations and Maintenance Division

The Operations and Maintenance Division is responsible for ensuring the physical integrity of park assets and infrastructure. Facility management includes responsibility for buildings, utilities, roads, trails, grounds, housing, and project management. The park staff maintains over \$150 billion worth of structures and infrastructure. One-third of park staff work in the division. This workforce includes electricians, gardeners, engineering equipment operators, and other specialists that work to ensure the parks are safe and prepared for visitors.

Responsibilities are divided geographically, as well as by asset type: trails, roads, housing, buildings, and utilities. Project management and special fund source projects also have separate groups. Nearly half of the park building square footage is occupied by park partners in exchange for assuming building maintenance and other responsibilities. Further, in 2009, park volunteers provided 24,500 hours of support toward maintenance projects, mostly trail projects. Despite creative approaches in supplementing the work of park staff, the workload needed to maintain and support the park assets exceeds the available staff resources, resulting in a significant maintenance backlog. The maintenance of aging infrastructure within the park requires increasing resources and results in increased operational and environmental risks. A majority of the maintenance needs

annually go unmet due to insufficient funding, which results in an increasing backlog of deferred maintenance.

Visitor and Resource Protection Division

This group includes responsibilities for law enforcement, structural fire suppression, and wildland fire control. Safety services are particularly unique within the park due to its urban location, its large area, and the variety of water and land-based recreation that occurs within the park. The staff in this division make up 30% of the total staff for the park. Law enforcement and the U.S. Park Police are responsible for enforcing law and protecting the public's safety. Law enforcement staff is organized into several geographic areas north and south of the Golden Gate Bridge. Patrol operations are conducted in marked and unmarked police cruisers, motorcycles, bicycles, on foot, horseback, and with all-terrain vehicles, although a lack of sufficient patrolling units has resulted in adverse impacts to the park's resources.

Safety services include search and rescue, emergency medical services, and structural and wildland firefighting. The structural fire department also includes paramedic support and lifeguards. Wildland fires are managed by a staff of nine. The Office of Fire Management monitors and responds to all wildland fires within the park and maintains an appropriate preparedness level in accordance with the park's 2006 fire management plan. Structural fires within the park and in the Presidio are handled by the Presidio Fire Department. The Golden Gate National Recreation Area's Fire Management Program is part of the San Francisco Bay Area Network. Fire staff based at Golden Gate National Recreation Area also serve Point Reyes National Seashore, John Muir National Historic Site, Eugene O'Neil National Historic Site, and Pinnacles National Monument. Professional lifeguards are located at Stinson Beach and patrol units cover the 6-mile stretch of Ocean Beach. A small park horse patrol, using 3 or 4 NPS horses, is managed by division staff, with over 7,200 volunteer hours provided in 2009.

Interpretation and Education Division

The Interpretation and Education Division aims to connect people to their parks. The division includes Community Outreach, Education Programs, and the Volunteers-In-Parks Program, and provides staff for specific interpretation services throughout Golden Gate National Recreation Area, Fort Point National Historic Site, and Muir Woods National Monument. Staff in this division make up 10% of the park's workforce, which includes permanent and term staff as well as students. The interpretation and education division has the responsibility of communicating the value and significance of the park and monument's resources to the public through signs, exhibits, brochures, ranger-led programs, and audio tours. Interpretation programs are offered at Alcatraz Island, Muir Woods National Monument, Fort Point National Historic Site, the Presidio, Fort Funston, the Sutro District, Marin Headlands, San Mateo County, the Crissy Field Center, and other locations throughout the park. Community Outreach staff are responsible for managing communications and outreach to the local community.

Education Programs staff deliver formal curriculum-based educational programs to approximately 20,000 Bay Area children annually on topics including habitat restoration, invasive species, marine biology, plate tectonics, geology formations, and day-to-day life

at Fort Point National Historic Site. The Volunteers-In-Parks program manages thousands of volunteers who contribute over 300,000 hours annually to park programs.

The demand for education and interpretive programs far exceeds what the park is currently able to deliver. Many valuable resources within the park and monument are not interpreted due to limited staff and funding for program development. Park partners such as the Bay Area Discovery Museum, Headlands Institute, Marine Mammal Center, Point Bonita YMCA, and Slide Ranch assist in meeting the public's demand for educational and interpretive programs; however, a significant gap remains between park offerings and the public demand.

Natural Resources Management and Sciences Division

The Natural Resources Division includes responsibility for protection of a diverse array of aquatic, vegetation, wildlife, and physical resources. The park's 80,500 acres of land and water extend from Tomales Bay in Marin County south into San Mateo County. Division staff manages the park's ecosystems and numerous plant and animal species, including many sensitive, rare, threatened, or endangered species. With only 4% of the park's total staff working in the division, including base-funded and project-funded staff, the division's work is further supported by specialists from the Golden Gate National Parks Conservancy and by Volunteers-In-Parks natural resource stewards. Current staffing levels prevent the park from completing the baseline studies and monitoring necessary to guide the park's natural resources preservation efforts in the future.

Management, Administration, and Business Services

This division makes up 15% of the park's staff and is responsible for integrating operations and organizational support across the park. The staff consists of personnel in Administration, Budget and Finance, Contracting and Procurement, Fee Collection, Human Resources, Information Technology, Public Affairs and Special Events, the Superintendent's Office, and the Office of Strategic Planning. The Business Management office oversees complex contracts and partnership agreements that provide key services within the park. The division also manages leases, concessions, and the legal aspects of park and partner projects, including property easements, encroachments, and acquisition of new lands.

PARTNERS AND OTHER ENTITIES

The Volunteer-In-Parks program is critical to the ongoing operation of Golden Gate National Recreation Area and Muir Woods National Monument. Volunteers provide between 300,000 and 400,000 volunteer hours to various programs and efforts within the park in a typical year. However, due to staff limitations to manage volunteer efforts, the volunteer program does not have the capacity to grow and provide additional benefit to the parks.

As a park partner for more than 24 years, the nonprofit Golden Gate National Parks Conservancy has provided more than \$80 million in assistance to the park and monument. This organization provides support with education and interpretation

programs and with the protection of natural and cultural resources; the Golden Gate National Parks Conservancy also collaborates with the National Park Service with visitor program partnerships, including the Crissy Field Center and the Institute of the Golden Gate. The organization has been instrumental in facilitating visitor enhancements throughout the park, including the spectacular transformation of Crissy Field, improvements to Alcatraz Island, and the successful Trails Forever program.

In addition to programs offered by the National Park Service, park visitors can enjoy programs provided by a number of nonprofit organizations in facilities owned by the National Park Service. There are many other excellent park partners who provide conservation restoration and protection, environmental education, outreach programs, and recreational opportunities that support the goals of the park while achieving their own organization's missions.

Many of the parks' better known partners are located in the Marin Headlands, just north of the Golden Gate Bridge. These include the Marine Mammal Center, Headlands Institute (a part of NatureBridge), Bay Area Discovery Museum, Headlands Center for the Arts, Point Bonita YMCA, and Hostelling International. The Fort Mason Center houses 23 nonprofit organizations and provides meeting, exhibit, recreation, and performance space in 11 historic landmark buildings. Alcatraz Cruises LLC (a part of Hornblower Cruises and Events) brings visitors to and from the island. The park staff continues to explore new partnerships and to improve ways to nurture and sustain them to extend ongoing collaborations.

PARK FACILITIES

The large size of Golden Gate National Recreation Area and Muir Woods National Monument, in combination with the diversity of natural and cultural resources and the history of land use, makes for numerous facilities to be maintained and managed. The park lands contain approximately 1,150 total facilities that include buildings, trails, roads, and other structures and landscapes.

The park has been at the forefront of asset management planning, and has creatively found ways to adaptively reuse historic buildings, to lease space to park partners, and to prioritize funding towards most needed maintenance and deferred maintenance. Sustainability goals are being incorporated into facility and systems construction. The park has also proactively worked with partners to obtain outside funding for projects.

Table 12: The Golden Gate National Recreation Area Portfolio Summarized by Record Count for Various Asset Types

Asset Type	NPS	Partner	Total
Historic Buildings	142	88	230
Nonhistoric Buildings	105	117	222
Maintained Landscapes	35	1	36
Trails	146	1	147
Paved and Unpaved Roads	215	1	216
Parking Lots	113	0	113
Water Systems	16	2	18
Wastewater Systems	13	2	15
Other Assets	187	4	191

Note: Many of the park's historic assets such as archeological sites and cultural landscapes are described in the Cultural Resources section.

Historic and Nonhistoric Buildings

Nearly half of the buildings within park lands are historic, carrying special consideration for maintenance. A significant number of buildings are managed and maintained by the partner organizations occupying them.

Maintained Landscapes

The park maintains landscapes for public use, such as the grounds surrounding buildings. The Upper Fort Mason grounds and the Alcatraz Island gardens are examples.

Trails, Roads, and Parking

The staff maintains paved and unpaved roads throughout the park. Roads need continual maintenance in which lack of funding reduces the ability to maintain them at an optimum level.

The park maintains extensive trail networks. Additional trails will be coming into park management with the acquisition of new areas in San Mateo County. The park has an extensive trails network, which is heavily used due to the urban park setting. This

requires diligent maintenance; it is a challenge to find funding sources to support the necessary work. Park partners assist in this area through donations.

The park maintains 113 parking lots, which range in size, and serve many of the major sites.

Utilities

Water and wastewater capacity are critical to all sites within the park lands. System needs vary over time and can be stressed by increases in use as well as the age and level of maintenance. Planning for utilities is critical in order to ensure excellence in operational effectiveness, sustainability, and conservation. Current water and wastewater system constraints occur at Alcatraz Island and Stinson Beach. Several systems are antiquated and many are failing and require constant maintenance. Replacement of these systems is a high priority.

Park Operations, Maintenance, and Public Safety Facilities

Park operations, maintenance, and public safety functions are presently scattered throughout the park at sites and facilities that were not intended for these uses. Staff carrying out these functions have been forced to adapt to conditions that do not adequately meet their space, size, function, mobility, and security requirements. Maintenance and public safety operations have moved numerous times over a short period, requiring staff to reprogram their operations; this has resulted in operational inefficiencies. Ideally, park maintenance and public safety staff would have adequate space for both personnel and facilities located with appropriate access to various park units. Additionally, sheltered space for a variety of equipment is needed for equipment protection and efficient operations.

Park Maintenance Facilities

For efficient operations, park maintenance staff require secured vehicle parking, ability to receive cell and radio transmissions, access to arterial roads and highways for moving equipment, and ideally access to transit for ease of access for staff. Many of these criteria are not currently met by the existing facilities. Given the coastal climate, with its salt air and blowing sand, equipment life is significantly shortened by storage outdoors or in unenclosed shelters. Currently, there is inadequate enclosed storage for maintenance equipment within the park.

Table 13: Maintenance Facilities

Location	Description
Muir Woods National Monument	
	Park maintenance is supported by a small office in the Administration-Concession Building, maintenance operations in the Old Inn, and facilities at Lower Conlon Avenue. These spaces support trail maintenance, building maintenance, and office space. A maintenance yard is located adjacent to Muir Woods Road near Conlon Avenue.
Marin County	
Stinson Beach	4 modular buildings for offices, a workshop, and storage
Tennessee Valley	Barn used for the storage of trail maintenance supplies and shared with the park horse patrol
Nike Missile Site	Maintenance yard, road maintenance operations, and for storage of fill materials
Fort Baker	Buildings and utilities shop and parking for vehicles and equipment (the building is temporary and scheduled for demolition to provide space for visitor parking)
Fort Cronkhite	Grounds maintenance operations, a sign shop, offices, and storage
San Francisco County	
Alcatraz Island	Park operations and maintenance facilities within former prison buildings
Upper Fort Mason	Grounds maintenance operations and administrative offices
East Fort Miley	A small onsite maintenance facility, heavy vehicle repairs, office space and shops on the east side in a warehouse and battery
Fort Funston	Park maintenance support located in former military structures
The Presidio	Additional maintenance functions and storage

Location	Description
San Mateo County	
Shelldance Nursery	Vehicle storage
Native Plant Nurseries	Small native plant nurseries are located at Tennessee Valley, Marin Headlands, and adjacent to Muir Woods Road in Marin County and at Fort Funston in San Francisco County. Another native plant nursery is located in the Presidio. The National Park Service, Presidio Trust, and the Golden Gate National Parks Conservancy cooperate in its use and management. All nurseries serve as volunteer stewardship centers and facilitate significant volunteer contributions to the parks natural resource and restoration programs.

Public Safety Facilities

Currently public safety staff shares space with other divisions throughout the park. This is less than ideal because there are certain public safety functions that need to be exclusive and secured. Further, efficient operation requires adequate space for training and meetings, visibility to the public for reporting incidents, adequate cell and radio coverage, and access to public transportation for staff. Current public safety facilities do not meet these requirements in each location, and reassignment of space for public safety is desirable.

Within Marin County, the park's public safety program has an office at Stinson Beach that provides space for law enforcement, water safety, and seasonal Emergency Medical Services staff, along with storage. Fort Cronkhite Building 1056 is the main, parkwide law enforcement office. The small park horse patrol is located at lower Tennessee Valley.

The park's public safety office in San Francisco County includes Presidio Building 223, Fort Miley and Upper Fort Mason, Fort Funston, and lifeguard operations at China Beach. The Alcatraz Island public safety office is housed in Building 64, the historic barracks on the north end of the island.

The public safety staff at Muir Woods National Monument is located in the Administration-Concession Building.

Residential Facilities

The park continues to provide some limited housing for employees. The park staff manages park housing units located in the Marin Headlands. Housing in the San Francisco Bay Area is among the most expensive in the United States. Recruitment and retention of employees for both the park and park partners are hindered by the expense of housing in the area and low number of available park housing units.

ASSET MANAGEMENT

With a large number of facilities and constrained funding, the park staff strives to address the challenge of maintaining assets in acceptable condition and sustaining them over time. Park staff is responsible for maintaining nearly 1,150 assets; base funding of \$5.3 million covers only a portion of the annual operations and maintenance requirements of \$24.6 million.

For the same NPS-occupied and NPS-maintained assets, annual special project funding of approximately \$6.0 million covers only a small portion of its \$148.8 million in deferred maintenance backlog. Including the park assets managed by park partners, total documented park deferred maintenance exceeds \$198.1 million.

In 2006, the park staff developed one of the first park asset management plans to describe its asset inventory, summarize its current budget, communicate funding requirements, and provide strategies to better manage assets that are essential to park operations and to high-quality visitor experiences. This document was updated in 2009.

Operations and Maintenance Funding Priorities

Assets maintained and managed by the park's Maintenance Division (e.g., nonpartner assets) were categorized into priority levels based on a variety of factors. Those factors include the importance of the assets to the mission of the park and the recognized level of maintenance needed to keep the assets operational to suit their intended functions.

Funding is then directed towards the highest priority assets, while lower priority assets will be maintained to the best level that limited available funding allows. However, even with prioritization, there remains \$2.9 million in priority band 1 and 2 assets that would remain unfunded and therefore represent the most pressing unfunded needs for operations and maintenance. See table 14.

Partner Assets

Roughly one-half of all park buildings are affiliated with partners or concessioners. While the park shares maintenance responsibility for many of these assets, most of the concession and partner facilities are under contractual arrangements. The park asset management plan has identified some specific funding needs and issues for key park partners; with new draft maintenance plans in place, park management can now follow-up with partners to clearly communicate recommendations for best addressing needed maintenance. The goal is for the park staff to help its partners identify and address maintenance needs in a way that sustains the overall asset portfolio in support of the park mission.

Table 14: Golden Gate National Recreation Areas Operation and Maintenance Planned Funding Summary

O&M* Optimizer Priority Band	Asset Count	Base O&M Allocations	O&M Benchmarks	Percent Coverage	O&M Funding Gap
• Highest Priority	81	\$3,561,497	\$5,148,089	69%	\$1,586,592**
• High Priority	133	\$1,012,566	\$2,405,661	42%	\$1,393,095**
• Medium Priority	132	\$545,513	\$2,298,316	24%	\$1,752,803
• Lower Priority	290	\$200,043	\$7,987,277	3%	\$7,787,234
• Lowest Priority	276	\$718	\$6,781,986	0%	\$6,781,268
Totals	912	\$5,320,337	\$24,621,329	22%	\$19,300,992

*Operation and Maintenance

**Gap for bands 1–2: \$2,979,687

Removal of Assets

Removing unneeded assets that are not mission related is essential to keeping the portfolio a manageable size and allowing available funding to be spent on a smaller pool of higher priority assets. In developing the GMP alternatives, the park staff identified potential assets that could be disposed of over the life of the plan. The facilities identified through this process generally consist of nonhistoric structures in poor condition with no mission related use existing or planned.

Addressing Deferred Maintenance

Recognizing that the park cannot reasonably address all of its deferred maintenance in the short run, the park has a schedule of facility projects that extends out 10 years; this plan addresses the highest priority assets and most critical equipment needs. The condition of these more important assets will show the most rapid improvement, measured by the facility condition index. If 100% of project funding were applied to critical needs and projected component renewal, the park would stabilize the condition of the critical components of its portfolio.

The GMP process has also identified deferred maintenance savings that would be achieved by taking the actions proposed in the alternatives. Deferred maintenance issues can be addressed through several actions recommended in the general management plan, including removal, stabilization, restoration, renovation, and preservation of facilities. The park is pursuing a reduction in deferred maintenance through other funding methods

as well, such as the use of historic leasing as a source of funds to reinvest in historic structures, pursuing Federal Land and Highway Program (FLHP) funds, pursuing annual special project funds, using a portion of proceeds from concession franchise fee funds, and dedicating some repair and maintenance funds for component renewal. The park will also continue to look for opportunities to work with partners in addressing deferred maintenance when updating or issuing new partner agreements.

Table 15: Project Funding and Deferred Maintenance

Type of Funding	Amount
Estimated Annual Special Project Funding	\$6.0 million
NPS Deferred Maintenance	\$148.8 million
Combined NPS and Partner Deferred Maintenance	\$198.1 million

Sustainability

In a ‘funding-constrained’ world, it is also extremely helpful for the park to identify more efficient ways of operating and managing its assets. The park staff has identified goals for achieving a higher level of sustainability, including managing and tracking energy performance, using renewable fuels, conserving water at high use areas, and continuing to enact best practices in waste management. The park managers also recognize the need to broadly communicate sustainability goals with park staff and to collaborate with park partners. These measures are opportunities for the park to find cost savings and become more fiscally responsible.

Coordination between the General Management Plan and the Park Asset Management Plan

Asset data from the park asset management plan helped to inform the development of the GMP alternatives. The updates of the park asset management plan, in light of the planning process for the general management plan, provide an extraordinary opportunity for park managers to promote sound asset management principles, incorporate the value and objectives of partnership relationships, and advance sustainability goals in a coordinated manner.