Fire Management Plan
Final Environmental Impact Statement

Golden Gate National Recreation Area

National Park Service
November 2005

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Lead Agency: National Park Service

This Final Environmental Impact Statement (FEIS) evaluates a Fire Management Plan (FMP) for lands within the Golden Gate National Recreation Area (GGNRA), Muir Woods National Monument, and Fort Point National Historic Site. The FMP that currently applies to these areas was adopted in 1993. The National Park Service (NPS) proposes to prepare a new FMP to reflect recent changes in fire management policy and the addition of newly acquired lands within the park boundary since the 1993 FMP was written.

The FEIS describes and assesses three alternative strategies, including a preferred alternative, for managing fire in the park to reduce risks to the public, firefighters, sensitive resources, and park facilities. The alternatives encompass a range of approaches to using prescribed fire and mechanical fuel reductions as tools for achieving fire risk reduction and resource protection and enhancement objectives. The alternatives are Alternative A – No Action, 1993 Fire Management Plan; Alternative B – Hazard Reduction and Restricted Fire Use for Research and Resource Enhancement; and Alternative C – Hazard Reduction and Resource Enhancement through Multiple Treatments. The NPS prefers Alternative C.

Impact topics assessed in the FEIS include: watershed processes, air quality, vegetation, wetlands, wildlife and important habitat, special status species, cultural resources, human health and safety, visitor use and visitor experience, park operations, and socioeconomics.

The public comment period on the DEIS began March 18, 2005 and ended on May 27, 2005. Comments and responses are presented in Appendix H of this FEIS. Comments were reviewed, considered, and the EIS was revised in light of those comments.

The Record of Decision adopting the alternative or actions constituting the approved plan will be prepared not sooner than thirty days after the publication in the Federal Register of the EPA's notice of filing of the FEIS. The complete FEIS will be posted on the GGNRA website at http://parkplanning.nps.gov/goga and directly mailed to recipients of the DEIS. For further information on the FMP, please check this website or call the GGNRA Fire Management Office at 415-331-6374.

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Executive Summary

Introduction

This Final Environmental Impact Statement (FEIS) evaluates alternative strategies for a Fire Management Plan (FMP) for lands within the Golden Gate National Recreation Area (GGNRA), Muir Woods National Monument, and Fort Point National Historic Site. The National Park Service (NPS) has prepared the DEIS in accordance with the National Environmental Policy Act (NEPA). The FEIS analyzes three alternatives for managing fire in the park. The alternatives are based upon park values, effective fire management strategies, NPS policy, and applicable law.

NPS Director's Order 18 (NPS 1998) requires that each park with vegetation capable of burning prepare a strategic, operational plan to guide a fire management program. An FMP is a strategic plan describing detailed procedures for managing the full range of fire management activities, including wildland fire suppression and fuel reduction projects. GGNRA (including Muir Woods National Monument and Fort Point Historic Site) is currently operating under a 1993 FMP. The NPS proposes to prepare a new FMP to reflect recent changes in fire management policy and the addition of newly acquired lands within the park boundary since the 1993 FMP was written.

The FEIS for the FMP describes and assesses alternative strategies for reducing risks to the public, firefighters, sensitive resources, and park facilities from wildland fire. The document also examines the opportunities to use prescribed fire and mechanical fuel treatments as tools for achieving fire risk reduction and resource protection and enhancement objectives. The FMP FEIS evaluates fire management planning at a general, "program" level.

A Notice of Availability for the DEIS was published in the Federal Register and the document made available for public review and comment on March 18, 2005. The Federal Register noticed a 60-day public comment period ending on May 17, 2005 but this was extended to May 27, 2005 to ensure adequate review time. Twelve comment letters were received on the DEIS during the public comment period. Responses are provided to all substantive comments made on the DEIS, and, where warranted, text changes were made to the FEIS text to reflect the response to the comment. Responses to all relevant comments submitted can be found in Appendix H – Response to Comments on the Draft Environmental Impact Statement. As the last action in the process, the NPS will prepare a Record of Decision documenting the selection of an alternative and conclusions of potential environmental effect.

The alternative selected at the end of this NEPA process will define the overall strategy for the park's fire management actions, serving as the basis for the FMP. The FMP is a separate, stand-alone operational document for fire management and fuel reduction actions in the park and will be completed following designation of the selected alternative in the Record of Decision. The FMP will identify areas of the park where fuel reduction actions will occur during the first five years of implementation; the five-year program will be reviewed and updated annually to reflect areas that have been treated and add other areas where treatment is needed. As an operational manual, the FMP will include sections on preparedness planning, firefighter standards, training requirements, wildfire suppression, monitoring, research, interagency cooperation, prescribed burning, fire prevention, and public education. FMP projects that

involve issues not sufficiently assessed by the programmatic EIS will be subject to additional environmental review prior to implementation.

Principal Differences and Clarifications Between the Draft and Final Environmental Impact Statements

The DEIS was revised in light of comments received during the public review period of the FMP DEIS which identified some sections of the document that required modification or further clarification. The following is a summary of the principal changes to the FEIS text in comparison to the DEIS:

- A tenth FMP goal, accompanied by two objectives, to address smoke management and protection of air quality has been added to the list of FMP goals in Chapter 1, Section 1.4.

- Figures 2-7 and 2-8 of the DEIS, which identify roads in GGNRA, were removed from the document and text edits were made in Chapter 2 to clarify which road-related functions at GGNRA are the responsibility of fire management staff and which are the responsibility of other NPS divisions.

- Additional information has been provided in Chapters 2 and 3 on herbicide use in conjunction with mechanical fuel removal. This includes information on the park's common herbicide used, the review and approval process, regulatory conformance, protections for sensitive resources, the public and firefighters.

- Changes have been made to the Mitigation Measures for Air Quality and Special Status Species found in Chapter 2, Section 2.7. In response to a comment from the U.S. Environmental Protection Agency, air quality mitigation measures AIR-1 and AIR-2 were combined to become AIR-1 and the balance of air quality mitigation measures were renumbered accordingly. As a result of the consultation between the NPS and the U.S. Fish and Wildlife Service (USFWS), two new Special Status Species mitigation measures, SS-5 and SS-6, were added and all Special Status Species mitigation measures greater than SS-4 were renumbered accordingly.

- Changes have been made to Chapter 4, Environmental Consequences, Impacts on Air Quality to clarify the relationship between BAAQMD's smoke management plan (SMP) and the State Implementation Plan (SIP). Text was added to address whether the three FMP alternatives would trigger a conformity analysis with the SIP; new text and a new table (4-3b: De Minimus Levels for State Implementation Plan Conformance) were also added to explain and state the *de minimus* levels for criteria pollutants with which the Air Basin is in nonattainment or maintenance status. Table 3-4 has been updated to reflect the current attainment status of criteria pollutants for the Bay Area Air Basin.

- A short description of the criteria and process by which projects were selected for inclusion in Appendix C – Cumulative Actions has been added to the introduction of Appendix C.

- In response to the EPA's request to further highlight smoke management practices in the FEIS, a new appendix has been added that is a listing of smoke management techniques and non-burning

alternatives that GGNRA could incorporate into a smoke management plan and/or that BAAQMD could require as part of the smoke management plan approval process. The referenced appendix is Appendix I – Non-burning Alternatives and Air Emissions Reduction Techniques for Fuel Reduction and Resource Benefiting Prescribed Burns in GGNRA.

- The NPS completed the consultation process for the FMP EIS as required for conformance with Section 106 of the National Historic Preservation Act (NHPA). This resulted in a Programmatic Agreement (PA) between the State Historic Preservation Officer (SHPO) and the NPS that directs the process the NPS will use to identify, evaluate, treat, and mitigate adverse affects to historic properties from implementation of the FMP. The Programmatic Agreement is included in the FEIS as Appendix J.

- The NPS has completed the formal consultation process with the USFWS as required for conformance with the Endangered Species Act (ESA). The USFWS has issued a Biological Opinion stating their conclusions of potential impacts of FMP actions on eleven wildlife species and four plant species listed as threatened or endangered under the ESA, as well as the impact on critical habitat designated for the one threatened species. The Biological Opinion is included in the FEIS as Appendix K.

Purpose of and Need for the Fire Management Plan

The 1993 FMP for GGNRA focuses primarily on natural resource management issues and needs to be revised to more fully address cultural resource concerns, provide guidance for parklands acquired since 1993, and provide more guidance on effectively reducing fire risk along the wildland urban interface areas in the park. A new FMP is needed to reflect the importance of a more concerted effort to effectively reduce wildfire risk to park resources and to private property along the wildland urban interface, and to examine the feasibility of facilitating the role of fire where it is safe to do so.

In addition, ecosystem changes in the park are evidenced by the spread of more flammable nonnative plant species, dense single-aged second-growth forests, conversion of shrublands to forest, forest and shrubland encroachment on grasslands, and decadence and decline of fire-adapted species. A new FMP is needed to provide a framework for managing these ecosystems and fuel loads. Important characteristics of cultural landscapes have also been altered in the absence of fire, and the risk of wildland fire damaging historic structures has increased as fuel loading has increased. A new FMP is needed to address management of increased fuel loads in the vicinity of cultural resources as well as within the park at large.

The purpose of the FMP is to provide a framework for all fire management activities in a manner that is responsive to natural and cultural resource objectives, reduces risks to developed facilities and adjacent communities, and provides for public and staff safety. The intent of this FEIS is to present and analyze alternatives for carrying out the fire management program at GGNRA. It also presents and analyzes effects that would occur as a result of implementing these alternatives. The purposes of this planning process are:

- To prepare a new FMP that is consistent with Federal Wildland Fire Management Policy and conforms to agency guidelines for fire management plans and programs; and
- To help achieve resource management objectives consistent with the park's cultural resource, natural resource, and land management plans, and to be responsive to safety considerations for park visitors, employees, and resources.

FMP Goals

As part of the planning process, FMP goals were developed by NPS staff to reflect federal policy as well as the comments and concerns expressed by the public during the scoping period. The goals were derived from guidance of the NPS Management Policies 2001 (2000) and NPS Director's Order and Resource Handbook 18, Wildland Fire Management, in addition to federal policy and scoping input. The goals and subsequent management objectives describe what must be accomplished in order for the fire management program to be successful and were used to formulate the alternatives analyzed in this FEIS. The FMP goals are as follows:

Goal 1. Ensure that firefighter and public safety is the highest priority for all fire management activities.

Goal 2. Reduce wildland fire risk to private and public property.

Goal 3. Protect natural resources from adverse effects of fire and fire management activities, and use fire management wherever appropriate to sustain and restore natural resources.

Goal 4. Preserve historic structures, landscapes, and archeological resources from adverse effects of fire and fire management activities, and use fire management wherever appropriate to rehabilitate or restore these cultural resources.

Goal 5. Refine management practices by improving knowledge and understanding of fire through research and monitoring.

Goal 6. Develop and maintain staff expertise in all aspects of fire management.

Goal 7. Effectively integrate the fire management program into park and park partner activities.

Goal 8. Foster informed public participation in fire management activities.

Goal 9. Foster and maintain interagency fire management partnerships and contribute to the firefighting effort at the local, state, and national level.

Goal 10. Minimize smoke generation during prescribed burning through the use of a smoke management plan (SMP) that details best management practices or non-burning alternatives where these options would meet resource management and fuel reduction objectives and also achieve emissions reduction.

Planning Issues Considered

Public scoping on this EIS began on August 8, 2003 and ran until December 5, 2003. (See Chapter 5, Section 5.1, Public Involvement and Scoping, for more information.) Scoping comments provided guidance to NPS staff in preparation of this EIS. Planning issues are the concerns raised by park staff, other government agencies, and the public that were used to develop and evaluate the alternatives in this document. Concerns ranged from the impacts of wildland fire to the impacts associated with management actions taken to manage fire and reduce fuels. The comments received by the NPS during scoping helped determine which issues and alternatives are relevant to this planning process and should be included in the EIS and which issues would be better addressed in another planning effort. Planning issues discussed in the EIS include impacts on the physical environment (watershed processes and air quality), the biological environment (vegetation, wetlands, wildlife, and special status species), and the social environment (cultural resources, human health and safety, visitor use and visitor experience, park operations, and socioeconomics).

Alternatives

Formulation of Alternatives

The process of formulating FMP alternatives began with an examination of federal policy for wildland fire management, NPS management policies, regulatory considerations, past wildland fire and prescribed fire experience in the park, GGNRA's natural and cultural resource objectives, input from the public and agencies during the scoping period, and analysis of potentially hazardous fuel conditions. An interdisciplinary team of NPS staff reviewed this information and developed goals and objectives for the FMP. NPS staff reviewed all public and agency scoping comments, including those from park staff, and developed a reasonable range of alternatives that would help achieve FMP goals and objectives to be assessed in the FEIS. NPS staff participating in scoping and alternatives development represented expertise in fire management, fire ecology, natural resource management, cultural resources, planning, public safety, interpretation, and public affairs.

Several alternatives were considered during the development of this FEIS, of which three are fully analyzed in this document. The others were considered carefully but rejected because they would not adequately meet the fire program's objectives. NEPA requires project proponents to identify a range of reasonable alternatives within an EIS. Reasonable alternatives must be economically and technically feasible and demonstrate common sense. Alternatives must meet stated goals and objectives for taking action to a large degree, and must be within identified constraints. The No Action alternative must be analyzed under NEPA requirements. For this FEIS, the No Action alternative represents no change in fire management actions as they have been implemented over the last several years and as they were described and analyzed in the 1993 FMP and its environmental assessment (EA).

The following are summaries of the three alternatives developed for GGNRA's FMP EIS:

Alternative A (No Action) – *1993 FMP, No Action*

This alternative would be an update to the 1993 FMP only to reflect changes to the park's boundary (e.g., addition of new lands since 1993) and current national fire management policies. The focus of the 1993 FMP program is on vegetation management through the application of prescribed fire to perpetuate fire-dependent natural systems. In recent practice, many fire management actions have been mechanical fuel reduction projects (e.g., mowing, cutting to remove nonnative shrubs and trees, and selective thinning in forested stands) as a result of the establishment of the Wildland-Urban Interface Initiative. A combination of staff shortages, the requirement to develop a new FMP, and a year-long moratorium on prescribed burning has resulted in limited prescribed burning over the past five years. This alternative would rely on the continued implementation of the 1993 FMP and recent emphasis on mechanical fuel reduction along with prescribed fire, and suppression of all wildfires. The fire management approach for Muir Woods National Monument would be the same for the No Action alternative and the two action alternatives (Alternatives B and C) and would include the use of prescribed fire as well as mechanical fuel reduction. Current research projects would continue and would focus on the role of fire to enhance natural resources and the effects of fire on key natural resources to determine the effectiveness of various fuel treatments.

Alternative B – *Hazard Reduction and Restricted Fire Use for Research and Resource Enhancement*

Under Alternative B, fire management actions would emphasize the use of mechanical methods to reduce fire hazards and fuel loads in areas with the highest risks. Compared to Alternative A, Alternative B would increase the number of acres mechanically treated each year, with a focus on the reduction of high fuel loads in the wildland urban interface area. The suppression strategy for wildfires and the approach used in the Muir Woods fire management unit (FMU) would be the same as under Alternative A. Limited use of prescribed fire could occur for research purposes within the park interior. Research projects would examine the role of fire to enhance natural resources and the effects of fire on key natural resources to determine the effectiveness of various fuel treatments. Natural and cultural resource goals and objectives would be integrated into the design and implementation of fuel reduction projects.

Alternative C (Preferred Alternative) – *Hazard Reduction and Resource Enhancement through Multiple Treatments*

This alternative would allow for the greatest number of acres to be treated on an annual basis to achieve fire management and resource objectives through the use of a broad range of fire management strategies. Mechanical treatment and prescribed burning would be used as a means to reduce fuel loading near developed areas and achieve resource enhancement goals. Mechanical treatments, complemented by prescribed fire, would be employed to assist with restoration and maintenance of the park's natural and cultural resources. The suppression strategy for wildfires and the approach used in the Muir Woods FMU would be the same as under Alternative A. Research projects would examine the role of fire to enhance natural resources and the effects of fire on key natural resources to determine the effectiveness of various fuel treatments; they would also be used to adaptively guide the fire management program and help to maximize the benefits to park resources. Natural and cultural resource goals and objectives would be integrated into the design and implementation of fuel reduction projects.

The three alternatives analyzed meet the park's goals and objectives to an acceptably large degree, and are within constraints imposed by regulations and policies, by risks associated with the wildland urban interface, and by technical and funding limitations. The three alternatives involve different combinations of prescribed burning and mechanical treatments. In each alternative, an upper limit has been set on the number of acres that would be burned or mechanically treated in any one year (see Table ES-1). These numbers are based upon an understanding of the park's resources, staffing and funding, hazard risk assessment, and technical feasibility.

Table ES-1: Summary of Alternatives by Annual Acres Treated and Treatment Type

Treatment Type	County	Alternative A[1]	Alternative B	Alternative C
Mechanical Treatment[2] (acres/year)	Marin	75	180	225
	San Francisco	5	10	10
	San Mateo	20	40	40
	TOTAL	100	230	275
Prescribed Burning (acres/year)	Marin	100	120	285
	San Francisco	<1	<1	<1
	San Mateo	10	0	35
	TOTAL	110	120	320

Source: NPS, GGNRA 2004.

[1] Estimated based upon current practice, since 1993 FMP did not specify number of acres per year for treatments.

[2] Mechanical treatment refers to fuel reduction through methods such as mowing, cutting, short-term grazing, and selective thinning.

Actions Common to All Alternatives

Several actions that are currently part of the fire management program at GGNRA would continue under all of the alternatives analyzed in this EIS. These activities are described below.

Wildland-Urban Interface Initiative

In 2001, the NPS began implementing provisions of the federal Wildland-Urban Interface Initiative program. This program was designed to facilitate cooperative ventures with park neighbors – including other federal agencies, states, counties, private landowners, and local fire agencies – to reduce the potential for wildland fire to burn from federal lands to neighboring properties. This is accomplished through implementation of fuel reduction projects in communities adjacent to GGNRA. Through this program, the NPS also receives funding for fuel reduction projects on parklands near the interface with private property or lands managed by other agencies. This program would continue under all alternatives, but the details of specific projects and related environmental analysis are independent from this EIS.

Defensible Space/Vegetation Clearing around Buildings

The protection of all buildings from wildfire within GGNRA would continue under all alternatives. NPS staff or private contractors would continue to clear vegetation around park structures. Individual structures would be assessed to determine the appropriate vegetation treatment based on fuel type and slope, building construction type, historic significance, and potential sources of ignition.

Roadside Fuel Reduction

The park routinely clears vegetation and debris from selected paved and unpaved roads that provide routes for emergency evacuation, public safety, and access for suppressing fires or conducting prescribed burns, or that serve as control lines for prescribed fire projects. Designated fire roads would continue to be maintained to allow for safe and efficient access and egress by emergency vehicles, at a minimum allowing access by Type III fire engines. The park would evaluate, on an ongoing basis, the condition of fire roads for direct and safe access conditions. As a result of this evaluation, unnecessary fire roads may be eliminated, in coordination with other park planning efforts, and the sites restored to address erosion problems. In some cases, existing roads may be reconfigured or rerouted to address erosion and/or maintenance concerns, but these actions would be subject to further study. The effects of these actions on cultural resources would be taken into account prior to implementation.

Suppression

The current policy at GGNRA is to suppress all unplanned ignitions using minimum impact suppression tactics (MIST) whenever possible and feasible given the constraints along the urban interface. Suppression of fires would be aggressive and would be conducted with the highest regard for human safety. Wildland fire suppression would be conducted to suppress wildfire at minimum cost consistent with values at risk, while minimizing the impacts from suppression activities. A “confine,” “contain,” or “control” strategy would be used in the suppression of all wildfires, with the majority of wildfires suppressed using the control strategy. Suppression would be accomplished through a combination of cooperative agreements with local fire agencies and qualified park fire personnel. Annual operating plans would identify individual suppression concerns in order to minimize suppression impacts. Furthermore, all control efforts would be evaluated for consideration of effects on resource values. Fire suppression methods used would be those that cause minimum resource damage while accomplishing effective control.

Treatment of Muir Woods FMU

Preservation of the pristine character of Muir Woods National Monument is a management priority stated in the 1993 FMP. Many species contribute to the ecosystem in and around Muir Woods National Monument and this diversity calls for a variety of prescription parameters. The objectives for the fire management strategy in Muir Woods are to:

- Restore the role of fire in the relevant vegetation communities;
- Reduce fuel loading and the threat of catastrophic wildfire; and
- Further study fire effects in old-growth coast redwood forest.

Under all three alternatives, the proposed fire management strategy for Muir Woods National Monument would be similar to that of the 1993 FMP and would include a mix of prescribed fire and mechanical fuel reduction. Prescribed burning would be used to reduce fuel loading and to benefit from the reintroduction of fire into the diverse plant communities in the monument. Prescribed fire would be used in the redwood/Douglas-fir forest to restore the role of fire to this ecosystem and may also be used for management of nonnative species in the monument. Small-scale mechanical fuel reduction projects, such

as construction of shaded fuel breaks and thinning of the understory, would be implemented as elements of an overall strategy to reduce the hazard of a high-intensity fire. Research in the monument could also employ prescribed burning to investigate the relationship between fire and Sudden Oak Death (SOD) and the use of prescribed burning in limiting or controlling French broom.

Treatment of San Francisco County Project Area

Much of the lands in GGNRA within the City and County of San Francisco are heavily used, containing coastal scrub and nonnatives or beach sand and bluff with little burnable vegetation. In a few areas, very dense, nonnative evergreen forest does pose a high fire hazard to the public and firefighters. Clearing dense vegetation from historic structures throughout the San Francisco parklands would benefit public safety and help preserve the structures in case of a wildfire or structural fire in the area. The fuel reduction strategy for the San Francisco lands – to maintain defensible space around buildings adjacent to wildland fuels and to provide some mechanical removal of nonnative evergreen trees – would improve firefighter safety and reduce the risk of a fire spreading from federal lands to the adjacent dense residential neighborhoods. No prescribed burning is proposed for the San Francisco County project area, including Alcatraz Island, except in conjunction with implementation of approved U.S. Fish and Wildlife Service recovery plan objectives for federally listed threatened and endangered plant species, which could entail research burns. The areas with the highest existing fire hazard contain nonnative and highly flammable trees or dense nonnative shrubs that could most effectively be treated by mechanical fuel reduction and follow-up maintenance.

Public Information and Fire Education Programs

The NPS manages an active fire information and education program within the park that also serves local communities. This program assists in educating NPS employees, volunteers, park partners, other agencies, park visitors, and the general public about fire management goals and policies. The fire information and education program is in the developmental stages at both local and national levels and is adding to what has been traditionally provided through GGNRA's Office of Public Affairs and the Division of Interpretation and Education. The program addresses fire safety and prevention, fuels management, the role of fire in GGNRA's ecosystems, GGNRA's fire history and the cultural use of fire on the landscape, and fire research programs and opportunities. The education program currently produces flyers for nearly all fire management projects within the park for distribution to the public, posting at the project site, and posting on the park's fire management web pages.

A comprehensive public information and education program would be included as part of all of the alternatives. Communication with the public, neighbors, visitors, partners, NPS employees, and the news media would be done using a variety of methods.

Fire Cache

The fire cache facilities store and supply the equipment and supplies necessary to support all fire operations within GGNRA, as well as two national park units in the East Bay – John Muir and Eugene O'Neill national historic sites. Currently, fire vehicles and equipment are stored in several facilities in the Marin Headlands and Fort Baker. Ideally, the fire cache would be housed in a single location at some time in the near future, resulting in a decrease in response time to major park assets and facilitating

communication among park staff members responsible for fire management. This cache/wildland station could potentially be an interagency facility in conjunction with the Marin County Fire Department or one of the city fire organizations. The park would conduct a facilities assessment for the fire cache to refine the program and storage needs and study options for relocation and consolidation. This assessment would be done in coordination with other interested agencies, and appropriate environmental review would be conducted for implementation.

Fire Effects Monitoring

Fire effects monitoring is essential to determining the effects of the fire program on GGNRA ecosystems and to providing guidance to the fire program for adaptive management. As part of the Fire Effects Monitoring Program, both prescribed burns and wildfires are monitored during a fire event for weather conditions, fire behavior, and air quality. In accordance with the NPS Fire Monitoring Handbook (FMH), vegetation and/or fuels data are collected both before and one, two, five and ten years after prescribed burns in order to assess whether or not the burn has met stated objectives. Both live fire monitoring as well as the establishment and monitoring of FMH plots as described above are carried out by the Fire Effects Monitoring Crew, which is hosted at Point Reyes National Seashore. Funding for the Fire Effects Monitoring Crew is provided through the National Fire Office. These monitoring efforts would continue under all three alternatives.

Environmental Impacts

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

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

The table on the following pages describes the range of impacts for each resource topic by alternative.

Table ES-2: Summary of Impacts

	Alternative A – 1993 FMP (No Action)	Alternative B – Hazard Reduction and Restricted Fire Use	Alternative C (Preferred Alternative) – Hazard Reduction and Resource Enhancement through Mult. Treatments
Watershed Processes: Soils, Hydrology, and Aquatic Habitat	Fire management actions under Alternative A would have adverse, short-term, minor effects on water quality, and beneficial, long-term minor-to-moderate effects on restoration of watershed hydrology. Effects of prescribed fire on water quality related to increased erosion would be adverse, minor and short-term. Impacts from soil disturbance related to mechanical treatments would be adverse, short-term, and negligible to minor. However, the watershed effects within the areas treated by mechanical means would be beneficial, long-term, and minor to moderate. Wildland suppression activities would affect soils due to compaction and ground disturbance. Because the number of acres burned by wildfires each year remains quite low, impacts on watersheds would be adverse, short-term, and minor.	Similar to Alternative A, with a small increase in the short-term, minor adverse effects and long-term beneficial effects due to the increased mechanical treatments.	Similar to Alternative A, with both increased short-term, minor adverse impacts and long-term beneficial impacts. The increased mechanical treatments and prescribed burning in this alternative would create the greatest number of beneficial effects.
Air Quality	The levels of VOC produced in this alternative would create a long-term, moderate, adverse impact. The levels of NO_X and SO_2 would create a long-term, negligible adverse impact. Smoke generation would create short-term, minor-to-moderate adverse impacts. Particulate matter would create long-term	The levels of VOC, NO_X, SO_2 produced in this alternative would create impacts similar to Alternative A. Smoke generation would create short-term, minor adverse impacts on visibility during prescribed or pile burning. This level would be reduced compared to Alternative A as burning is	The levels of VOC, NO_X, SO_2 produced in this alternative would create impacts similar to Alternative A. Smoke generation would create impacts similar to Alternative B. Particulate matter would create long-term moderate adverse impacts. Cumulative effects would be long-term,

Table ES-2: Summary of Impacts

	Alternative A – 1993 FMP (No Action)	Alternative B – Hazard Reduction and Restricted Fire Use	Alternative C (Preferred Alternative) – Hazard Reduction and Resource Enhancement through Mult. Treatments
	minor adverse impacts. Cumulative impacts would be long-term, moderate, and adverse. There would be long-term major beneficial effects in reducing the potential for catastrophic fires.	restricted to the Interior FMU. Particulate matter would create long-term moderate adverse impacts. Cumulative impacts on basin air quality would be long-term, moderate, and adverse. There would be long-term minor beneficial effects in reducing the potential for catastrophic fires.	moderate, and adverse. Long-term moderate beneficial effects would be created by the accelerated treatment of fire management areas.
Vegetation	Overall, Alternative A in combination with other related actions would have cumulative long-term negligible effects on vegetation. Mechanical treatments would have negligible-to-minor long-term beneficial impacts on coastal scrub, chaparral, grasslands, herbaceous wetlands, riparian forest and scrub, native hardwood forests, and Douglas-fir and coast redwood. These benefits would only persist if follow-up actions prevent the encroachment of nonnative species. Short-term minor adverse impacts could occur in these communities due to ground disturbance. Prescribed burning could have negligible-to-minor, long-term beneficial impacts on most native vegetation communities, although more study of grasslands is required.	Similar effects to Alternative A, with a slight increase in beneficial impacts from more mechanical treatment. However, the use of prescribed burning would be more limited than in Alternative A, which would reduce the beneficial effects of this treatment in the WUI FMU.	Increased mechanical treatments and prescribed burning in this alternative relative to Alternatives A and B would result in an overall minor-to moderate, long-term beneficial effects on vegetation. A broader range of management actions and a more comprehensive method for identifying, prioritizing, and implementing specific fire management actions would allow for larger-scale restoration of ecologically sustainable stands of native vegetation.

Table ES-2: Summary of Impacts

	Alternative A – 1993 FMP (No Action)	Alternative B – Hazard Reduction and Restricted Fire Use	Alternative C (Preferred Alternative) – Hazard Reduction and Resource Enhancement through Mult. Treatments
Wetlands	Overall, fire management activities would have minor-to-moderate long-term benefits to wetland communities through reduction of nonnative plant species, stimulation of native species, and reduced potential for a large-scale wildfire. Mechanical treatments and prescribed fire could have adverse, short-term, minor impacts on wetland soils, hydrology, and vegetation. Fire management activities would avoid wetland areas to the greatest extent possible, and a buffer would be maintained around wetland areas where fire management activities would be restricted. Any impacts on wetland soils, hydrology, or vegetation that occur in the buffer area would be correctable by site-specific actions, and must be confined to short-term, minor (or less) adverse effects.	Similar to Alternative A, with a small increase in the short-term, minor adverse effects and long-term beneficial effects due to the increased prescribed burning in the Park Interior FMU.	Similar to Alternative A, with both increased short-term, minor adverse impacts and long-term beneficial impacts due to increased mechanical treatments and prescribed burning in both the Park Interior and WUI FMUs.

Table ES-2: Summary of Impacts

	Alternative A – 1993 FMP (No Action)	Alternative B – Hazard Reduction and Restricted Fire Use	Alternative C (Preferred Alternative) – Hazard Reduction and Resource Enhancement through Mult. Treatments
Wildlife	Fire management activities would have overall long-term, beneficial, minor effects on wildlife and important habitat. Mechanical removals and prescribed burns would create beneficial, long-term impacts by enhancing native habitats and reducing chances for catastrophic fires. These effects would outweigh the minor adverse impacts of vegetation removal and associated disturbance.	Overall, impacts on wildlife under Alternative B would be very similar to those under Alternative A. More areas would be subjected to mechanical treatment under Alternative B, but the impacts would remain beneficial, long-term, and minor.	Impacts on wildlife would be similar to Alternatives A and B, with overall beneficial, long-term, and minor effects. This alternative would allow for the greatest and most flexible use of mechanical treatment and prescribed fires, which would create the highest level of beneficial effects. Alternative C would allow for the greatest amount of research, which would provide park staff the greatest opportunity for adaptive management.
Special Status Species – Wildlife	No impairment to any threatened and endangered species would occur under Alternative A.	No impairment of any threatened and endangered species would occur under Alternative B.	No impairment of any threatened and endangered species would occur under Alternative C.
San Bruno Elfin Butterfly	Mechanical fuel reduction, prescribed burning, pile burning, and research burns would not occur directly in areas supporting San Bruno elfin butterfly habitat, but may occur in adjacent habitat. Adverse impacts would be negligible to minor and short-term. Potential beneficial impacts from reduced risk of catastrophic wildfire and removal of nonnative vegetation would be minor and long-term.	Impacts would be similar to those for Alternative A, with the potential for a slight increase in the extent of impacts as the amount of land that could be treated under Alternative B would be about twice as much as in Alternative A. Beneficial impacts would be the same as in Alternative A.	Same as Alternative A.
Mission Blue Butterfly	Adverse impacts on mission blue butterflies and their habitat from site disturbance and vegetation removal, associated with mechanical fuel reduction and prescribed fire, would be minor and short-term	Adverse impacts from mechanical fuel reduction in Alternative B would be slightly greater than in Alternative A since more than twice the acreage would be treated, but still minor and	Similar to Alternative B, with a moderate increase in the amount of lands that could be treated under Alternative C. Greatest potential for minor-to-moderate long-term beneficial impacts due to

Table ES-2: Summary of Impacts

	Alternative A – 1993 FMP (No Action)	Alternative B – Hazard Reduction and Restricted Fire Use	Alternative C (Preferred Alternative) – Hazard Reduction and Resource Enhancement through Mult. Treatments
	following mitigation, with moderate, long-term, beneficial impacts through protection and expansion of mission blue butterfly habitat. Research burns conducted in existing mission blue butterfly habitat would have short- to long-term adverse impacts. Burning less than 5 percent of existing habitat in any one year, under an approved research plan, would minimize impacts. Research burns could result in long-term beneficial effects.	short-term following mitigation. The long-term beneficial impacts from potential increased expansion of mission blue butterfly habitat would be greater in Alternative B.	extensive use of mechanical treatment, prescribed fire and research burns that could be used to improve and expand mission blue butterfly habitat.
Tidewater Goby	Adverse impacts from mechanical fuel reduction, prescribed burning, pile burning, and fire research would be short-term and negligible to minor following mitigation since none of these activities would occur directly within tidewater goby habitat.	Same as Alternative A.	Same as Alternative A.
Coho Salmon and Steelhead	Mechanical fuel reduction would result in short-term, minor adverse impacts resulting from potential disturbance to soils and vegetation in riparian areas, with long-term beneficial impacts from restoration of riparian habitat through removal of nonnative trees.	Impacts would be similar to those for Alternative A, with a slight increase in the extent of impacts as the amount of land that could be treated under Alternative B would be more than twice the amount in Alternative A. Potential for greater long-term beneficial impacts through restoration of riparian habitat by removal of nonnative vegetation.	Similar to Alternatives A and B, with a slight increase in the extent of both adverse (short-term, minor) and beneficial impacts (long-term, minor) due to increased amount of areas treated.

Table ES-2: Summary of Impacts

	Alternative A – 1993 FMP (No Action)	Alternative B – Hazard Reduction and Restricted Fire Use	Alternative C (Preferred Alternative) – Hazard Reduction and Resource Enhancement through Mult. Treatments
California Red-Legged Frog	Mechanical fuel reduction, prescribed fire, and research burns may result in short-term, negligible-to-minor adverse impacts related to disturbance in or adjacent to red-legged frog habitat. Long-term, minor beneficial impacts could result from reducing the threat of catastrophic wildfire that could adversely affect wetland habitat.	Same as Alternative A.	Same as Alternative A.
San Francisco Garter Snake	Mechanical fuel reductions, use of prescribed fire, research burns, associated vegetation removal, and heavy equipment operation have the potential for adverse, minor, short-term impacts on the San Francisco garter snake following mitigation. Long-term, minor beneficial impacts would result from these actions by reducing the threat of catastrophic wildfire that could adversely affect garter snake habitat, and by restoring and maintaining coastal grassland and scrub habitat.	Impacts associated with mechanical fuel reduction and pile burning would be the same as in Alternative A. Even though twice as many acres may be treated in San Mateo and San Francisco counties, garter snake habitat is unlikely to be targeted for these activities. Prescribed burning and research burns would not occur in San Mateo County under Alternative B so there would be no associated impacts.	Same as Alternative A.
Marbled Murrelet	Potential marbled murrelet habitat is only present in the Muir Woods FMU. Fire management activities that focus on protecting and enhancing coast redwood and Douglas-fir trees, such as mechanical fuel reduction and prescribed burning, would result in overall long-term, beneficial, and minor impacts on this species.	Same as Alternative A.	Same as Alternatives A and B.

Table ES-2: Summary of Impacts

	Alternative A – 1993 FMP (No Action)	Alternative B – Hazard Reduction and Restricted Fire Use	Alternative C (Preferred Alternative) – Hazard Reduction and Resource Enhancement through Mult. Treatments
Western Snowy Plover	The only potential impacts on western snowy plovers would be from suppression activities that are common to all alternatives. Plovers would not be affected by any other actions in Alternative A.	Same as Alternative A.	Same as Alternative A.
California Brown Pelican	Impacts on roosting brown pelicans would be negligible by avoiding use of helicopters for mechanical fuel reduction in areas adjacent to Bird Island, and Rodeo and Bolinas Lagoons. Impacts from drifting smoke during prescribed burns, pile burning, or research burns would also be negligible.	Same as Alternative A.	Same as Alternative A.
Northern Spotted Owl	Adverse impacts associated with vegetation removal and disturbance during mechanical fuel reduction, prescribed fire, research burns, and pile burning would be minor and short-term, following mitigation. Long-term, minor beneficial impacts on spotted owls and their prey would result from native habitat restoration and enhancement and by reducing the threat of catastrophic wildfire.	Impacts from mechanical fuel reduction and pile burning would be similar to those for Alternative A, with a slight increase in the extent of both adverse and beneficial impacts. Impacts associated with prescribed burning and fire research would be the same as in Alternative A.	Similar to Alternative B, with a moderate increase in the extent of both adverse (short-term, minor) and beneficial impacts (long-term, minor) as the amount of land treated annually under Alternative C would be greater than in Alternative B. Impacts of prescribed fire would be similar to Alternatives A and B, with an increase in the extent of both adverse (short-term, minor) and beneficial impacts (long-term, minor) as the number of acres subject to burning annually under Alternative C would be more than twice that under Alternative A or Alternative B.

Table ES-2: Summary of Impacts

	Alternative A – 1993 FMP (No Action)	Alternative B – Hazard Reduction and Restricted Fire Use	Alternative C (Preferred Alternative) – Hazard Reduction and Resource Enhancement through Mult. Treatments
Salt Marsh Harvest Mouse	Adverse impacts from mechanical fuel reduction, prescribed burning, pile burning, and fire research would be short-term and negligible to minor following mitigation, since none of these activities would occur directly within potential salt marsh harvest mouse habitat.	Same as Alternative A.	Same as Alternative A.
Special Status Species – Plants	Suppression actions with mitigation measures applied whenever possible would reduce potential effects of wildland fire suppression to short-term, adverse, and negligible to minor. A prescribed burn, properly timed and mitigated, could have a long-term, major, beneficial impact on Oakland star tulip. Prescribed burning would have a short-term, negligible, adverse effect and long-term, beneficial impact on California bottle-brush grass. Most special status plants would have a minor-to-moderate benefit from reduction of nonnative species as a result of prescribed burning and mechanical treatment in all three counties. Removal of nonnative trees and shrubs and carefully conducted research burns (in consultation with the USFWS) could result in long-term, minor, beneficial impacts on the same three federally listed species in San Francisco. Monitoring programs would	Effects of mechanical treatment would be more limited in types of plant communities affected and have a reduced adverse effect on special status plants compared to Alternative A – negligible to minor, long-term, and beneficial. Effects of prescribed burning would be the same as in Alternative A with the exception of no burning in San Mateo County and the ability to conduct burns in the chaparral in Marin County. Short- and long-term, minor, beneficial effects on the three species on Bolinas Ridge would occur. Overall, this alternative would have long-term, negligible-to-minor, beneficial effects.	Mechanical treatments would affect more acreage, resulting in minor-to-moderate, long-term, beneficial impacts throughout all FMUs. Prescribed burning would occur in all areas of the park, resulting in a larger number of acres treated that Alternatives A and B. Opportunity for broadcast burns would be minor-to-moderate, long-term, and beneficial.

Table ES-2: Summary of Impacts

	Alternative A – 1993 FMP (No Action)	Alternative B – Hazard Reduction and Restricted Fire Use	Alternative C (Preferred Alternative) – Hazard Reduction and Resource Enhancement through Mult. Treatments
	have a minor-to-moderate long-term, beneficial impact. No prescribed burning would occur in chaparral communities, so there would not be beneficial impacts on three locally rare fire-adapted species on Bolinas Ridge.		
Cultural Resources	This alternative would have short-term, moderate, beneficial effects on historic buildings by reducing fuels around these structures. Moderate, long-term, beneficial effects on cultural landscapes would result from their restoration or maintenance through prescribed fire or mechanical treatments. This alternative would have the potential for long-term, adverse, major effects on archeological resources from suppression effort with heavy equipment. A large-scale uncontrolled wildfire could have long-term, major, adverse effects on historic buildings and cultural landscapes with loss of historic features and structures.	Beneficial effects on historic buildings and cultural landscapes would be greater than in Alternative A, as additional acreages for mechanical treatments and prescribed fire would be allowed for resource management objectives. Likewise, there would be a potential for greater adverse impacts on archeological resources, but these could be kept short-term and minor with appropriate mitigation measures.	Beneficial effects would be greater than in Alternatives A and B, but would remain in the moderate category.
Human Health and Safety and Nuisance Effects	Overall, this alternative would have a long-term, minor benefit to the public and firefighter safety by decreasing the risk of catastrophic fire. The potential to breathe in particulates and other toxins in the smoke produced by prescribed burning and fire suppression would have a short-term, negligible adverse	Similar to Alternative A, except that increased treatments would render long-term, moderate benefits to public and firefighter safety.	Similar to Alternative B, except larger prescription burning component would yield long-term, moderate, beneficial effect.

Table ES-2: Summary of Impacts

	Alternative A – 1993 FMP (No Action)	Alternative B – Hazard Reduction and Restricted Fire Use	Alternative C (Preferred Alternative) – Hazard Reduction and Resource Enhancement through Mult. Treatments
	effect on public and fire staff health and safety.		
Visitor Use and Visitor Experience	This alternative would have a short-term, minor adverse effect on visitor experience, public access, aesthetics, and park soundscapes from mechanical fuel reduction and prescribed burning. A long-term, moderate beneficial effect on the visitor experience and aesthetics would be gained due to improved viewsheds and enhanced growth of native vegetation.	Similar to Alternative A. More mechanical fuel reduction than Alternative A would mean more areas would be disturbed in short-term, but projects would be dispersed to reduce impacts on visitor experience in one area.	Similar to Alternative A with potential for larger burn areas. Related activity could result in short-term, minor-to-moderate and adverse effects. Following site restoration, effects would be long-term, moderate, and beneficial.
Park Operations	Moderate, long-term adverse effects on park operations would be anticipated from the full implementation of this alternative due to current staffing limitations throughout the park. Scaling back the implementation of Alternative A may reduce adverse effects on park operations to minor, but could result in reduced accomplishments and a longer time period needed to achieve FMP goals. One-time funding of a new fire cache would have a short-term moderate adverse impact on the park's budget, but would have long-term minor benefits on efficiency in fire management operations. Under any scenario, the suppression of a large-scale wildfire would have a short-term adverse major effect on park operations, management, and budget.	Similar to Alternative A but with an increased budget to conduct additional mechanical treatment projects. Under this alternative, 16.25 FTEs in the Wildland Fire Office would be required.	An overall increase in fire management program in order to conduct additional prescribed burning and mechanical treatment projects compared to Alternatives A and B. This alternative would produce moderate, long-term adverse impacts on park operations compared to the full implementation of Alternative A. FMP goals could be met in expedient timeframe, so long-term effect would be minor and beneficial. Under this alternative, 18 FTEs in the Wildland Fire Office would be required.

Table ES-2: Summary of Impacts

	Alternative A – 1993 FMP (No Action)	Alternative B – Hazard Reduction and Restricted Fire Use	Alternative C (Preferred Alternative) – Hazard Reduction and Resource Enhancement through Mult. Treatments
	Under this alternative, 13 FTEs in the Wildland Fire Office would be required.		
Socioeconomics	Overall, socioeconomic impacts associated with budget and payroll under the planned mechanical treatments and prescribed fire could be characterized as negligible, short-term benefits under all three alternatives. Tourism would not be affected by short-term closures, but could be reduced by the occurrence of a catastrophic fire. This would reduce spending on lodging, food, and travel. However, these effects could be offset by an increased demand for services by employees involved in fire suppression and restoration. Hence, the economic impacts of these larger events may have both beneficial and adverse short-term and minor effects.	Same as Alternative A.	Same as Alternative A.

Notes:
WUI = Wildland Urban Interface
FMU = Fire Management Unit
SOD = Sudden Oak Death
VOC = volatile organic compounds
NO_X = nitrogen oxides
SO_2 = sulfur dioxide
USFWS = U.S. Fish and Wildlife Service
FTEs = full-time equivalents