Appendix K – U.S. Fish and Wildlife Service Biological Opinion

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
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Sacramento, California 95825-1846

In reply refer to:
1-1-05-F-0104

October 7, 2005

Memorandum

To: Superintendent, Golden Gate National Recreation Area, National Park Service, San Francisco, California

From: ~~Acting~~ FOR Field Supervisor, Sacramento Fish and Wildlife Office, Sacramento, California Chief Nagano

Subject: Formal Consultation on the Fire Management Plan for Muir Woods National Monument, Golden Gate National Recreation Area, and Fort Point National Historic Site in Marin, San Francisco, and San Mateo Counties, California

This is in response to your March 4, 2005, request for formal consultation with the U.S. Fish and Wildlife Service (Service) on the Fire Management Plan at the Golden Gate National Recreation Area, Muir Woods National Monument, and Fort Point National Historic Site in Marin, San Francisco, and San Mateo counties, California. Your letter was received by this Field Office on March 16, 2005. The National Park Service requested our concurrence that the proposed project is not likely to adversely affect the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*), tidewater goby (*Eucyclogobius newberryi*), California brown pelican (*Pelecanus occidenatalis californicus*), San Francisco garter snake (*Thamnophis sirtalis tetrataenia*), Raven's manzanita (*Arctostaphylos hookeri* ssp. *raveni*), San Bruno elfin butterfly (*Incisalia mossii bayensis*), mission blue butterfly (*Icaricia icarioides missonensis*), and the threatened marbled murrelet (*Brachyramphus marmoratus marmoratus*), San Francisco lessingia (*Lessingia germanorum*), Marin dwarf flax (*Hesperolinon congestum*), California red-legged frog (*Rana aurora draytonii*), Pacific Coast Population of the western snowy plover (*Chardrius alexandrinus nivosus*), and the northern spotted owl (*Strix occidentalis caurina*), and proposed critical habitat for the California red-legged frog. We also have included the endangered Presidio clarkia (*Clarkia franciscana*) in this document. This biological opinion analyzes the effects to listed species that would result from the implementation of Alternative C, as described in the *Golden Gate National Recreation Area Fire Management Plan Draft Environmental Impact Statement* (DEIS) dated March 2005. This biological opinion is issued pursuant to the Endangered Species Act of 1973, as amended (Act) and in accordance with the regulations governing interagency consultations (50 CFR § 402).

The Service considers the protection of human life and safety to be of the utmost importance and highest priority; the Act contains provisions for conducting emergency actions that involve listed species (50 CFR § 402.05). We recommend the National Park Service review the Act and/or contact us for further details regarding these procedures.

The National Park Service should contact NOAA- Fisheries regarding the potential effects of the proposed project on the threatened Central California steelhead (*Oncorhynchus mykiss*), threatened California coast coho salmon (*Oncorhynchus kisutch*), and the endangered white abalone (*Haliotis sorenseni*).

This biological opinion is based on: 1) your March 4, 2005, letter, to the Service; 2) *Golden Gate National Recreation Area Fire Management Plan Draft Environmental Impact Statement* (DEIS) dated March 2005, that was prepared by the U. S. National Park Service; 3) *Point Reyes National Seashore Threatened and Endangered Species Locations as of 2001*, undated, that was prepared by the National Park Service; 4) *Biological and Essential Fish Habitat Assessment for Federally-listed and Candidate Species Potentially affected by the Golden Gate National Recreation Area's Fire Management Plan* (Biological Assessment) dated January 2005 that was prepared by the National Park Service; 5) an electronic mail message from the National Park Service to the Service dated October 6, 2005, that contained comments on the draft biological opinion; and 6) other information available to the Service.

The Service concurs with the determination that the proposed project is not likely to adversely affect the salt marsh harvest mouse, tidewater goby, California brown pelican, and the Pacific Coast Population of the western snowy plover because of the avoidance measures included in the proposed project, the proposed project is either outside of the range of the listed species, or the action area does not contain suitable habitat for the taxa.

The October 6, 2005, electronic mail message from the National Park Service to the Service stated that they had determined the proposed project is likely to adversely affect the San Bruno elfin butterfly. However, the Service does not concur and we have concluded this listed animal is not likely to adversely affected due to the avoidance measures that are contained in the proposed project.

The Service concurs with the determination that the proposed project is not likely to adversely affect the northern spotted owl because of the measures that will be implemented by the National Park Service. According to the BA, the measures include the following:

1. Treatment activities described in the BA and DEIS or any noise generation above ambient noise levels will not occur within 0.25 mile of a known occupied or previously used northern spotted owl nest site, or within potential spotted owl habitat between February 1 and July 31 (breeding season), or until such date as surveys conforming to accepted protocol have determined that the site is unoccupied or non-nesting or nest failure is confirmed.

2. Mechanical fuel reduction activities in suitable spotted owl habitat, known or potential, will not substantially alter the percent cover of canopy over-story and will preserve multilayered structure. When shaded fuel break features in suitable northern spotted owl habitat are constructed, the resulting multilayered canopy will only be reduced to a height of 6 to 8 feet, or along roadways as needed for emergency vehicle clearance.

3. Prior to fire management activities, project areas will be surveyed for the presence of dusky footed woodrat (*Neotoma fuscipes*) nests. If feasible, woodrat nests will be protected.

4. Within northern spotted owl habitat, the cutting of native trees greater than 10 inches diameter at breast height (dbh) will be avoided unless a determination is made that the native tree presents a clear hazard in the event of a fire or is the only option to reduce high fuel loading.

5. The fire management officer will arrange for qualified biologists to conduct post-project monitoring to determine short- and long-term effects of fire management actions on spotted owl activity centers if resources are available.

The Service concurs with the determination that the proposed project is not likely to adversely affect the marbled murrelet because of the measures that will be implemented by the National Park Service. According to the BA, the measures include the following:

1. Where marbled murrelet habitat overlaps northern spotted owl habitat, the restrictions on noise generation in spotted owl habitat above the level of ambient noise is extended to August 5. Further, from August 6th through September 30th, noise generation should be limited to ambient noise levels from two hours before sunset to two hours after sunrise to protect any nesting marbled murrelets that have not been noted during surveys.

2. In marbled murrelet habitat, avoid felling very large Douglas fir or coast redwood trees and establish the fire perimeter at a distance that will preclude the need to fell large trees.

The Service does not concur that the proposed project is not likely to result in adverse effects to the threatened California red-legged frog, proposed critical habitat for the California red-legged frog, San Francisco garter snake, mission blue butterfly. San Francisco lessingia, Raven's manazanita, Marin dwarf flax, and the Presidio clarkia.

Consultation History

March 16, 2005: The Service received the request for the initiation of formal consultation from the Park Service that was dated March 4, 2005.

April 2005: The Service received a copy of the DEIS from the National Park Service.

September 12, 2005: The Service requested additional information from the National Park Service on the proposed project.

September 12, 2005: The National Park Service provided the Service with the requested information via electronic mail and telephone.

September 16, 2005: The Service sent the National Park Service a draft of the biological opinion for their review and comment.

October 6, 2005: The National Park Service sent the Service comments on the draft biological opinion.

BIOLOGICAL OPINION

Description of the Proposed Action

The purpose of the Fire Management Plan is to provide a framework for all fire management activities for the Golden Gate National Recreation Area, including suppression of unplanned ignitions, prescribed fire, and mechanical fuels treatments. It is intended to guide the Fire Management Plan for approximately the next 10-15 years. The plan includes concise program objectives, details on staffing and equipment, and comprehensive information, guidelines, and protocols relating to the management of unplanned wildfire, prescribed burning, and mechanical fuels treatment. The Fire Management Plan is described in detail in the DEIS.

The Golden Gate National Recreation Area consists of 74,816 acres in San Mateo, San Francisco and Marin counties in California. Within the Golden Gate National Recreation Area legislative boundary are lands directly managed by the National Park Service, including Muir Woods National Monument and Fort Point National Historic Site. The majority of the Park is in Marin County and includes former military lands in the Marin Headlands and Fort Baker, and the 554-acre Muir Woods National Monument. The proposed Golden Gate National Recreation Area Fire Management Plan addresses 15,152 acres that are directly managed by the National Park Service and contain burnable vegetation. The San Francisco park lands include nearly all of the City's Pacific Ocean shoreline and lands formerly held by the military at Fort Mason, the coastal portion of the Presidio, and Alcatraz Island. The larger park units in San Mateo County are Milagra Ridge and Sweeney Ridge, both former military sites between the cities of Pacifica and San Bruno. The 1,200-acre Phleger Estate is the southernmost area in the Golden Gate National Recreation Area.

The National Park Service is directly involved with actions involving federally-listed species in both Areas A and B of the Presidio in San Francisco. The National Park Service has full responsibility for actions in Area A (the coastal and bayside perimeter of he Presidio) and conducts projects under the Presidio Vegetation Management Plan (VMP). As provided in the VMP, the National Park Service subject matter experts provide resource management expertise and work collaboratively with Presidio Trust staff on projects involving wetlands or native plant communities in Area B. The National Park Service also coordinates the volunteer stewardship program whose volunteers maybe working in both Areas A and B under the guidance of National Park Service staff in areas with listed plants. This biological opinion for the Golden Gate National Recreation Area Fire Management Plan will apply to all National Park Service fire

management actions with Area A and those fire management actions in Area B that involve pacticipation by National Park Service staff or National Park Service funding.

Under Alternative C, the preferred alternative in the DEIS, mechanical treatment (e.g., mowing, grazing, selective thinning) and prescribed burning, including broadcast burns, 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 throughout the Park. All wildfires would be suppressed. Research projects would examine the role of fire to enhance resources and the effects of fire on key natural resources to determine the effectiveness of various fuel treatments. They could also be used to adaptively guide the fire management program and help to maximize the benefits to Park resources.

There are three Fire Management Units (FMU) identified within the DEIS:

1. Unit 1, Wildland Urban Interface (WUI): This FMU includes lands that border developed or "interface" zones. The basic WUI zone was defined as any land within 1,200 feet of an urban/developed area. Where it made practical management sense, the WUI FMU boundary was extended to fire roads, trails, and jurisdictional boundaries. Lands within this FMU are characterized by a close proximity to values at risk (i.e., houses, infrastructure, etc.), typically high hazard fuel loads or slopes (sometimes with dry, easterly wind exposure), and high visitation (increased chance of ignitions).

2. Unit 2, Park Interior: This FMU is the largest and is characterized by a lower probability of fire threatening structures and a greater potential for using prescribed fires to achieve some resource management goals. The park interior lands include larger expanses of natural areas and cultural landscapes, inclusive of ranching and farming lands, and contain relatively intact native plant communities and contiguous areas and corridors of wildlife habitat.

3. Unit 3, Muir Woods National Monument: The designation of Muir Woods National Monument as an FMU is based on the area's unique at-risk values (first-growth redwoods), the area's high visitation (ignition potential), and an ongoing fire management program for this area.

Table 1 presents the number of acres of Park lands that are within each FMU and within each County for the preferred GGNRA Fire Management Plan alternative.

Table 1: Total acreage in each FMU and County for the preferred alternative.

FMU	Marin	San Francisco	San Mateo	Total Acres
WUI	2,524	922	1,479	4,925
Park Interior	7,910	N/A	1,765	9,675

FMU	Marin	San Francisco	San Mateo	Total Acres
Muir Woods	552	N/A	NA	552
Total Acres	10,986	922	3,244	15,152

Table 2: Annual Acres to be treated within each Fire Management Unit and County per Treatment Type

Treatment Type	County	Maximum to be treated per County (acres/year)	Acres to be treated per FMU Unit (per year)			
			WUI	Park Interior	Muir Woods	Total
Mechanical Treatment[1] (acres/year)	Marin	225	130	90	5	225
	San Francisco	10	10	0	0	10
	San Mateo	40	30	10	0	40
	TOTAL	275	170	100	5	275
Prescribed Burning (acres/year)	Marin	285	50	185	50	285
	San Francisco	<1	<1	NA	NA	<1
	San Mateo	35	5	30	0	35
	TOTAL	320	55	210	50	315

The fire management actions, treatments and methods proposed under the FMP in the DEIS and the BA are as follows:

Suppression

Suppression includes all actions taken to put out an active fire, and is defined as the restriction of the spread of a wildland fire and the elimination of all threats from that fire. All unplanned ignitions would be suppressed using minimum impact suppression tactics. Fire suppression methods will attempt to minimize the disturbance of all threatened and endangered species and their habitats to the greatest extent feasible (e.g. when these activities do not preclude life, safety or private property considerations).

Suppression includes all actions taken to put out an active fire. Fire suppression methods typically include fire line construction and laying hose. A fire handline (approximately 18 to 24 inches wide) is cut and cleared to bare mineral soil using chainsaws, shovels, and other hand tools such as Pulaskis (a shovel/hoe firefighting tool) and McLeods (a scraper firefighting tool). Fire line construction can include cutting brush, limbing trees, and cutting snags.

It is also possible that, during an emergency situation where an unplanned ignition has grown to a large and dangerous size, the National Park Service would authorize the use of heavy motorized equipment such as bulldozers to construct larger and longer fire lines. Other fire suppression activities require limited off-road vehicle use by trucks, fire engines, and lowboys for hauling heavy equipment. Aircraft dropping retardant foam and water may occur during suppression of unplanned ignitions. Since retardant (e.g., Phoschek®) contains phosphorus, retardants will avoid streams or wetlands to the greatest extent feasible. Helicopters may also be used to deliver water, foam, and/or retardant.

Mechanical Treatment

Mechanical treatment is the application of various tools and equipment to reduce fuels and achieve fire and resource management goals. The Park uses mechanical treatments, including mowing, grazing, and selective thinning, to remove hazardous fuels around buildings, along travel corridors, and in a number of places within the Park where wildland fuels grow directly against the urban interface (i.e., along the boundaries where there are houses and other built developments). Priorities would be set annually, and the projects performed throughout the year within allowable seasons based upon the incorporation of conservation measures. The most common method of mechanical fuel reduction is through the use of chainsaws to thin or remove targeted vegetation, which is then piled to be burned at a later date, or chipped using a chipper. In other instances, such as for fire road maintenance, large mowers and brush-cutting attachments are used for controlling vegetation. Mechanical treatment may include: fuel breaks – clearing corridors of vegetation; shaded fuel breaks – reducing density of underbrush, removing tree limbs; mosaics of cleared areas, areas with reduced vegetation density, and uncleared areas; Use of animals (such as goats) to reduce fuels; removal of non-native trees and treatment of cut stumps with herbicide; defensible space/vegetation clearing around buildings – reducing hazardous fuels from 30-50 feet around structures; and roadside fuel reduction from designated paved and unpaved roads that provide emergency evacuation, public safety and access for fire suppression activities – actions would include grading surfaces when necessary, vegetation removal, tree limbing, etc. In many cases, mechanical treatments would be used to compliment prescribed burning, with the two being implemented hand-in-hand to address specific fire, cultural, and natural resource management objectives.

Prescribed Fire

Prescribed fire is the use of management-ignited fire to meet specific resource and fire management goals and objectives under pre-defined fuel and weather conditions. The focus for prescribed burns would be on areas where the National Park Service determines that ecosystem health would be enhanced by burning and on areas where fuel accumulations create fire hazards. To the extent possible, prescribed burns would be conducted to achieve burn objectives and enhance natural resource conditions.

Prescribed burns intended for resource enhancement initially would be small and would be subject to intensive monitoring and research. If research results indicated that ecological conditions were improving after prescribed burns in certain habitat types, the size of prescribed

burns in these habitat types could increase. All prescribed burns would be conducted under specific burn plans in accordance with national fire policy requirements.

Once the prescribed burn project area is determined, fire and resource management staff would define its boundaries, which would include incorporating survey information regarding sensitive species and their habitat. This information, plus an analysis of affected physical or natural resources, fuel loading, access routes, staging areas, approved equipment, and burn techniques and strategies, would be included in a burn plan that would be submitted for recommendation to the Park superintendent. After the burn plan is approved by the superintendent, and other regulatory approvals are received (e.g. Bay Area Air Quality Management District) the project site would be prepared for the burn.

Pile Burning

Pile burning is the controlled burning of piles created during mechanical fuel reduction activities or general park maintenance operations. Pile burning would be used when chipping vegetation material is not feasible. Pile burning is also done in conjunction with prescribed burning (in the first phase) to reduce fuel loads to a level allowing for burning over the landscape. Pile locations are sited to minimize effects from intensive soil heating (pile sizes are limited to 4 cubic yards). Piles are also sited to minimize any effects to sensitive species and their habitats. Piles are covered, allowed to dry, and then typically burned during wet conditions when the probability of fire extending beyond the piles is low. As pile burning contributes emissions to the Bay Area Air Basin, an application would be made to Bay Area Air Quality Management District and approval received prior to burning.

Monitoring, Research and Education

An integral component of the proposed project is a monitoring and research program that allows the park to document basic information, to detect trends, and to ensure that parks meet their fire and resource management objectives. A fire research program would also continue as a component of the proposed project. New research would be initiated as needed to direct the prescribed burning program, including habitat enhancement actions for special status species. A comprehensive public information and education program would be included as part of all of the alternatives.

Proposed Conservation Measures

Fuel reduction actions described in the DEIS would be implemented in conjunction with avoidance measures designed to minimize or avoid potential environmental effects to listed species. In many cases, specific avoidance measures have been developed for the protection of individual listed species. The following general avoidance measures have been developed and would be applied to each fire management action with potential to affect a listed species or its habitat:

1. National Park Service staff will conduct a training session for all contractor crews at the beginning of new fuel reduction projects to familiarize the crews with sensitive resources at the project site and review project conditions. Training sessions may include identification of National Park Service resource contacts, special status plants, wildlife or other sensitive resources in the work area, identification and specific removal techniques to protect cultural resources from disturbance or prevent resprouting of nonnative plants, markings for the limit line of disturbance, thresholds that trigger a change in implementation techniques or require a halt in project implementation, proper disposal of food waste and garbage to discourage feeding by vectors and corvid birds, daily close-up of the project site to assure public safety and information for public contacts during project implementation.

2. An education program for field personnel involved with implementation of FMP projects will be conducted prior to the initiation of field activities. The program may include a brief presentation on any listed species at the work area including a description of the species and its ecology, habitat needs, legal status and protection afforded to the species.

3. Fires would be allowed to back into, around or through wetlands and meadows to avoid suppression damage. Wetlands will be avoided to the greatest extent possible during constructing fire lines and breaks during wildfire suppression. Where wetlands are used as a natural boundary to help contain a fire, the control line will be sited outside the wetland area. Trample lines (rather than dug lines) may be used if it is necessary to site the control line in the wetland.

4. Foams, saltwater or other fire retardants will not be used on or near wetlands to the greatest extent possible.

5. Prescribed burns will be conducted at a time of year when introduction or spread of non-native plants will be minimized, and mortality of non-native plant species will be maximized.

6. Soil disturbance during mechanical treatments, prescribed burns, and suppression fires will be minimized to the greatest extent possible to reduce potential for introduction or spread of invasive non-native plant species, to protect topsoil resources and to reduce available habitat for new non-native plant species.

7. Areas subject to fire management treatments would be monitored periodically for the presence of invasive non-native plant species; if such species become established or spread as a result of such activities, the non-native, non-historic plants will be removed.

8. All vegetation management actions under the FMP will conform to Federal and State regulations governing interstate and intrastate restrictions (respectively) adopted to prevent the artificial spread of Sudden Oak Death (*Phytophthora ramorum*) beyond the currently affected area. It will be the responsibility of the natural resources division chief to ensure that current guidelines and regulations are circulated to National Park Service staff involved in fire management actions. Current regulations do not permit the movement of specific plant

species and associated material outside of the regulated quarantine area that includes Marin, San Francisco, and San Mateo counties.

9. All FMP projects will incorporate techniques that control existing populations of weed species at the project site and incorporate practices to reduce the potential spread of weed species to non-infested areas of the Park.

10. Practices to reduce the spread of weed species include: a) restrictions on the movement or deposition of fill, rock, or other materials containing weed seed or viable plant cuttings to areas relatively free of weeds; b) where feasible based on the density of the weed population present, the fire management project manager will survey the road shoulders of the routes that provide project access for non-native plant species and coordinate removal of those plants that could be disturbed by passing vehicles; and c) when project vehicles are required to move from off-road use in weed-infested areas to relatively weed-free areas, and water lines and water tenders are available for use, the tires and body of heavy equipment and vehicles will be hosed down before each transit to the relatively weed-free area.

11. No herbicide use will be administered through the park's integrated pest management (IPM) coordinator and only licensed personnel may apply pesticides. All herbicide use for fire management actions will be reported monthly to the IPM coordinator.

12 No herbicide foliar spraying or direct stump applications will be allowed in riparian or wetland habitats supporting special status species except in the dry season..

13. When emergency actions must be taken to prevent imminent loss of human life or property and these actions would result in a taking of listed species or adverse modification of critical habitat not covered under existing FMP biological opinion, the National Park Service will respond to the situation in an expedient manner to protect human health and safety. After the incident is under control, the National Park Service will initiate emergency consultation procedures with the appropriate agency(ies).

14. The fire management project manager will ensure that contractor crews working in areas designated as habitat of listed species are monitored by a qualified biological monitor to ensure that project actions conform to restrictions developed for species protection.

15. All fire management actions will operate under a policy of No Net Loss of Endangered Species Habitat which applies to all species federally-listed as threatened or endangered or proposed for listing. The project review process will be used to document the no net loss finding through the conformance assessment conducted for each FMP action proposed for listed species habitat.

16. To avoid the spread of highly non-native animal species (e.g. bullfrogs = *Rana catesbeiana*) and protect the habitat of federally-listed threatened or endangered species, Golden Gate National Recreation Area resource advisors and fire management staff will advise local fire agencies responding to wildland fires in the Park and vicinity of the following guidance:

Drawing water from freshwater bodies in Golden Gate National Recreation Area and Rodeo Lagoon should be avoided unless there are no alternative sources available. If freshwater is drawn or scooped from water bodies in the park it should be used on wildfires within the same watershed, whenever possible.

17. Ocean and bay waters are preferred water sources for fighting wildfires in the Park and vicinity. Habitats of sensitive aquatic species and mission blue butterflies should be avoided when saltwater is used.

18. Prescribed burns, mechanical treatments, and mowing of shrubs and grasses taller than 8 inches will not be conducted during the bird-nesting season, from March 1 through July 31st, unless a qualified biologist conducts a pre-project survey for nesting birds and determines that birds are not nesting within the project area. To the greatest extent possible, these activities will be planned and conducted outside bird-nesting season. In intensively managed landscapes where mowing is justified for fuel reduction, vegetation shall be maintained at a height of less than 8 inches throughout the nesting season (March 1st through July 31st) to discourage the nesting of ground-dwelling bird species.

19. In order to protect nesting raptors, trees shall not be removed between January 1st and March 1st unless qualified personnel conduct a pre-project survey for nesting birds and determine that birds are not nesting within the project area. If nesting raptors are detected, a qualified biologist will delineate a suitable buffer.

20. Since older burn piles could provide wildlife habitat, the piles should be spread out (to move out animals) as much as possible before burning. If moving the piles is not feasible, the fire management project manager will ensure that piles are lit from one side only (with firefighters on the ignition side), so any wildlife in the pile can run out.

21. For prescribed fire projects proposed in the Muir Woods National Monument FMU, the fire management project manager will arrange for bat surveys of the tree hollows within the burn unit to be conducted by a qualified biologist to identify potential maternity colonies. Measures will be implemented to protect active maternity roosts.

Species-Specific Conservation Measures for Listed Species

Raven's Manzanita, San Francisco Lessingia, and Marin Dwarf Flax

1. Potential effects associated with tree removal in the vicinity of the Raven's manzanita, San Francisco Lessingia and Marin dwarf flax will be evaluated in consultation with the Service.

2. To address fire actions occurring within special status plant species populations, site and/or species specific rehabilitation plans will be developed to minimize or avoid impacts to the greatest extent possible.

3. When FMP actions disturb the habitat of special status plant species, revegetation and weeding plans will be developed in conjunction with project planning.

4. The potential for research burning and/or mechanical fuel treatments to enhance federally listed threatened or endangered plant habitat will be investigated. Burning in these habitats will be limited to carefully prescribed research burns, designed in conjunction with the Service and in accordance with established recovery plan objectives. Experimental treatments will be scientifically designed with replicate controls and a commitment to post-treatment monitoring.

San Francisco Garter Snake

1. No heavy equipment will be used off of existing fire roads or developed features in areas of known San Francisco garter snake habitat. If use of heavy equipment and trucks is required during emergency situations or for work that would improve habitat for this listed species, compensation measures to avoid mortality will be incorporated into the project schedule. Measures to avoid mortality include hand clearing areas prior to fire management activities, hand excavating all burrows, trapping snakes out of the excavation area, using monitors to prevent equipment from injuring listed species, and training workers on identification and avoidance of listed species. Work will be conducted by biologists with a valid section 10(a)(1)(A) permit and any collected individuals will be relocated outside affected areas.

Mission Blue Butterfly

1. Fire management activities will not occur within or immediately adjacent to existing or potential mission blue butterfly habitat during the flight period of the butterfly from February 15th through July 4th.

2. Pile burning is only permitted on barren, disturbed soils in mission blue butterfly habitat.

3. During the information meeting with local fire agencies, the location of mission blue butterfly habitat will be identified. During this meeting and when providing information at an active wildland fire as a resource advisor, natural resources staff will advise the local fire agency of the following guidelines: a) avoid staging fire suppression actions in or directly adjacent to mission blue butterfly habitat; b) construct fire lines outside of mission blue habitat to the greatest extent possible; c) use wet lines wherever feasible, or narrow, hand-constructed fire lines where water is not available to help contain the spread of the fire, and d) avoid using saltwater or retardant on habitat of the mission blue butterfly.

4. The potential for research burning and/or mechanical fuel treatments to enhance butterfly habitat will be investigated. Burning in mission blue habitat will be limited to carefully prescribed research burns. Experimental treatments will be scientifically designed with replicate controls and a commitment to post-treatment monitoring. No more than five

percent of existing mission blue butterfly habitat in each county will be treated experimentally annually.

5. Where possible, maintain a 100-foot-wide buffer between fire management activities and mission blue habitat except when fires are being conducted for research purposes. For habitat enhancement projects, additional measures will include establishment of buffer areas, flagging *Lupinus albifrons* in the vicinity of activities, installation of temporary fencing, dust control, and worker education.

6. The fire management project manager will arrange for the removal of non-native plants from in and adjacent to mission blue habitat following fire management actions, including fire suppression.

California Red-legged Frog

1. All suitable habitat within areas proposed for fire management activities will be surveyed and flagged by a qualified biologist to determine if the site supports suitable breeding or non-breeding areas for the California red-legged frog.

2. To protect direct injury to California red-legged frogs, removal of vegetation within suitable frog habitat will be accomplished by a progressive cutting of vegetation from the overstory level to ground level to allow frogs to move out of the treatment area.

3. If likely habitat is identified at the project site, a qualified and permitted biologist will follow accepted protocol and collect and relocate any individual red-legged frogs to nearby suitable habitat, in accordance with the biological opinion from the Service.

Status of the Species

California red-legged frog

The California red-legged frog was listed as a threatened species on May 23, 1996, (U.S. Fish and Wildlife Service 1996). Please refer to the final rule and the *Recovery Plan for the California Red-Legged Frog (Rana aurora draytonii)* (U.S. Fish and Wildlife Service 2002) for additional information on this species.

This species is the largest native frog in the western United States (Wright and Wright 1949), ranging from 1.5 to 5.1 inches in length (Stebbins 2003). The abdomen and hind legs of adults are largely red; the back is characterized by small black flecks and larger irregular dark blotches with indistinct outlines on a brown, gray, olive, or reddish background color. Dorsal spots usually have light centers (Stebbins 2003), and dorsolateral folds are prominent on the back. Larvae (tadpoles) range from 0.6 to 3.1 inches in length, and the background color of the body is dark brown and yellow with darker spots (Storer 1925).

The California red-legged frog has paired vocal sacs and vocalize in air (Hayes and Krempels 1986). Female frogs deposit egg masses on emergent vegetation so that the egg mass floats on

the surface of the water (Hayes and Miyamoto 1984). This animal breeds from November through March with earlier breeding records occurring in southern localities (Storer 1925). Individuals occurring in coastal drainages are active year-round (Jennings *et al.* 1992), whereas those found in interior sites are normally less active during the cold season.

The historic range of the California red-legged frog extended coastally from the vicinity of Elk Creek in Mendocino County, California, and inland from the vicinity of Redding, Shasta County, California, southward to northwestern Baja California, Mexico (Fellers 2005; Jennings and Hayes 1985; Hayes and Krempels 1986). This amphibian was historically documented with 46 counties but the taxa now remains in 238 streams or drainages within 23 counties, representing a loss of 70 percent of its former range (U.S. Fish and Wildlife Service 2002). The California red-legged frog is still locally abundant within portions of the San Francisco Bay area and the central coast. Within the remaining distribution of the species, only isolated populations have been documented in the Sierra Nevada, northern Coast, and northern Transverse Ranges. The species is believed to be extirpated from the southern Transverse and Peninsular ranges, but is still present in Baja California, Mexico (California Department of Fish and Game 2004).

Adult California red-legged frogs prefer dense, shrubby or emergent riparian vegetation closely associated with deep (>2.3 feet), still, or slow-moving water (Hayes and Jennings 1988). However, frogs also have been found in ephemeral creeks and drainages and in ponds that may or may not have riparian vegetation. The largest densities of California red-legged frogs currently are associated with deep pools with dense stands of overhanging willows (*Salix* spp.) and an intermixed fringe of cattails (*Typha latifolia*) (Jennings 1988). Individuals disperse upstream and downstream of their breeding habitat to forage and seek sheltering habitat.

During other parts of the year habitat includes nearly any area within 1-2 miles of a breeding site that stays moist and cool through the summer (Fellers 2005). According to Fellers (2005), this includes coyote bush (*Baccharis pilularis*) California blackberry thickets (*Rubus ursinus*), and root masses associated with willow (*Salix* species) and California bay trees (*Umbellularis californica*). Sometimes the non-breeding habitat used by the California red-legged frog is extremely limited in size, for example, a 6-foot wide Coyote bush thicket growing along a tiny intermittent creek surrounded by heavily grazed grassland (Fellers 2005). Sheltering habitat for red-legged frogs is potentially all aquatic, riparian, and upland areas within the range of the species and includes any landscape features that provide cover, such as existing animal burrows, boulders or rocks, organic debris such as downed trees or logs, and industrial debris. Agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hay ricks may also be used. Incised stream channels with portions narrower and depths greater than than 18 inches also may provide important summer sheltering habitat. Accessibility to sheltering habitat is essential for the survival of red-legged frogs within a watershed, and can be a factor limiting frog population numbers and survival.

The California red-legged frog does not have a distinct breeding migration (Fellers 2005). Adult frogs are often associated with permanent bodies of water. Some frogs remain at breeding sites all year while others disperse. Dispersal distances are typically less than 0.5 mile, with a few individuals moving up to 1-2 miles (Fellers 2005). Movements are typically along riparian

corridors, but some individuals, especially on rainy nights, move directly from one site to another through normally inhospitable habitats, such as heavily grazed pastures or oak-grassland savannas (Fellers 2005). Dispersing frogs in northern Santa Cruz County traveled distances from 0.25 mile to more than 2 miles without apparent regard to topography, vegetation type, or riparian corridors (Bulger *et al.* 2003).

Egg masses contain about 2,000 to 5,000 moderate sized (0.08 to 0.11 inches in diameter), dark reddish brown eggs and are typically attached to vertical emergent vegetation, such as bulrushes (*Scirpus* spp.) or cattails (Jennings *et al.* 1992). Red-legged frogs are often prolific breeders, laying their eggs during or shortly after large rainfall events in late winter and early spring (Hayes and Miyamoto 1984). Eggs hatch in 6 to 14 days (Jennings 1988). In coastal lagoons, the most significant mortality factor in the pre-hatching stage is water salinity (Jennings *et al.* 1992); eggs exposed to salinity levels greater than 4.5 parts per thousand results in 100 percent mortality (Jennings and Hayes 1990). Increased siltation during the breeding season can cause asphyxiation of eggs and small larvae. Larvae undergo metamorphosis 3.5 to 7 months after hatching (Storer 1925; Wright and Wright 1949; Jennings and Hayes 1990). Of the various life stages, larvae probably experience the highest mortality rates, with less than 1 percent of eggs laid reaching metamorphosis (Jennings *et al.* 1992). Sexual maturity normally is reached at 3 to 4 years of age (Storer 1925; Jennings and Hayes 1985). California red-legged frogs may live 8 to 10 years (Jennings *et al.* 1992). Populations of the California red-legged frog fluctuates from year to year. When conditions are favorable this species can experience extremely high rates of reproduction and thus produce large numbers of dispersing young and a concomitant increase in the number of occupied sites. In contrast, red-legged frogs may temporarily disappear from an area when conditions are stressful (*e.g.*, drought).

The diet of the California red-legged frog is highly variable. Hayes and Tennant (1985) found invertebrates to be the most common food items. Vertebrates, such as Pacific tree frogs (*Pseudacris regilla*) and California mice (*Peromyscus californicus*), represented over half the prey mass eaten by larger frogs (Hayes and Tennant 1985). Hayes and Tennant (1985) found juvenile frogs to be active diurnally and nocturnally, whereas adult frogs were largely nocturnal. Feeding activity probably occurs along the shoreline and on the surface of the water (Hayes and Tennant 1985). The diet of red-legged frogs apparently has not been studied, but their diet probably is similar to other ranid frogs that feed on algae, diatoms, and detritus by grazing on the surface of rocks and vegetation (Fellers 2005; Kupferberg 1996a, 1996b).

Several researchers in central California have noted the decline and eventual local disappearance of California and northern red-legged frogs (*Rana aurora aurora*) in systems supporting bullfrogs (Jennings and Hayes 1990; Twedt 1993), red swamp crayfish (*Procambarus clarkii*), signal crayfish (*Pacifastacus leniusculus*), and several species of warm water fish including sunfish (*Lepomis* spp.), goldfish (*Carassius auratus*), common carp (*Cyprinus carpio*), and mosquitofish (*Gambusia affinis*) (L. Hunt, in litt. 1993; S. Barry, in litt. 1992; S. Sweet, in litt. 1993). Habitat loss, non-native species introduction, and urban encroachment are the primary factors that have adversely affected the red-legged frog throughout its range.

Several researchers in central California have noted the decline and eventual disappearance of the populations of the California red-legged frog once bullfrogs became established at the same site (L. Hunt, in litt. 1993; S. Barry, in litt. 1992; S. Sweet, in litt. 1993). This has been attributed to both predation and competition. Twedt (1993) documented bullfrog predation of juvenile northern red-legged frogs, and suggested that bullfrogs could prey on subadult northern red-legged frogs as well. In addition to predation, bullfrogs may have a competitive advantage over red-legged frogs; bullfrogs are larger, possess more generalized food habits (Bury and Whelan 1984), have an extended breeding season (Storer 1933) during which an individual female can produce as many as 20,000 eggs (Emlen 1977), and larvae are unpalatable to predatory fish (Kruse and Francis 1977). In addition to competition, bullfrogs also interfere with red-legged frog reproduction. Both California and northern red-legged frogs have been observed in amplexus with (mounted on) both male and female bullfrogs (Jennings and Hayes 1990; Twedt 1993; M. Jennings, in litt.1993; R. Stebbins in litt. 1993). Thus bullfrogs may be able to prey upon and out-compete California red-legged frogs, especially in sub-optimal habitat. The urbanization of land within and adjacent to California red-legged frog habitat has also impacted the species. These declines are attributed to channelization of riparian areas, enclosure of the channels by urban development that blocks red-legged frog dispersal, and the introduction of predatory fishes and bullfrogs.

Mao *et al.* (1999 cited in Fellers 2005) reported northern red-legged frog infected with an iridovirus, which also was presented in sympatric three-spined sticklebacks (*Gasterosteus aculeatus*) in northwestern California. Ingles (1932a, 1932b, and 1933 cited in Fellers 2005) reported four species of trematodes from red-legged frogs, but he later synonomized two of them.

The recovery plan for the California red-legged frog identifies eight recovery units (U.S. Fish and Wildlife Service 2002). The establishment of these recovery units is based on the Recovery Team's determination that various regional areas of the species' range are essential to its survival and recovery. The status of the red-legged frog will be considered within the smaller scale of recovery units as opposed to the overall range. These recovery units are delineated by major watershed boundaries as defined by U.S. Geological Survey hydrologic units and the limits of the range of the red-legged frog. The goal of the recovery plan is to protect the long-term viability of all extant populations within each recovery unit. Within each recovery unit, core areas have been delineated and represent contiguous areas of moderate to high California red-legged frog densities that are relatively free of exotic species such as bullfrogs. The goal of designating core areas is to protect metapopulations that, combined with suitable dispersal habitat, will allow for the long term viability within existing populations. This management strategy will allow for the recolonization of habitat within and adjacent to core areas that are naturally subjected to periodic localized extinctions, thus assuring the long-term survival and recovery of the California red-legged frog.

The action area falls within Core Area # 13 - the Point Reyes Peninsula recovery unit which includes portions of watersheds at Point Reyes National Seashore and Golden Gate National Recreation Area. Within this recovery unit, California red-legged frogs are threatened primarily by water management and diversions, non-native species, livestock, and urbanization. Populations of the California red-legged frog in this region are relatively robust where habitat is

available. California red-legged frogs have been observed extensively within the boundaries of grazed and ungrazed lands within Point Reyes National Seashore and Golden Gate National Recreation Area. A number of created breeding ponds within Point Reyes National Seashore and Golden Gate National Recreation Area are at risk due to deteriorating dams.

There are recent sightings of the California red-legged frog in the Golden Gate National recreation Area in Marin County and San Mateo County (California Department of Fish and Game 2004; BA, DEIS; Service files; National Park Service undated). In addition, adult California red-legged frogs are highly mobile and may move considerable distances from their breeding ponds. Suitable habitat is found in and adjacent to the action area. Areas of containing aquatic and upland habitat exist within the action area. The action area contains components that can be used by the California red-legged frog for feeding, resting, mating, movement corridors, and other essential behaviors. Therefore, the Service believes that the California red-legged frog is reasonably certain to occur within the action area because of the biology and ecology of the animal, the presence of suitable habitat in and adjacent to the action area, as well as the recent observations of this listed species.

California Red-Legged Frog Proposed Critical Habitat

The final rule determining critical habitat for the California red-legged frogs was published in March 2001(U.S. Fish and Wildlife Service 2001). This rule established 31 critical habitat units based on three primary constituent elements: (a) essential aquatic habitat; (b) associated uplands; and (c) dispersal habitat connecting essential aquatic habitat. In November 2002, the U.S. District Court for the District of Columbia vacated most of the 2001 designation and ordered the Service to publish a new critical habitat proposal. On April 13, 2004, the Service re-proposed 4.1 million acres in 28 California counties as critical habitat for the frog (U.S. Fish and Wildlife Service 2004). This proposed rule basically re-proposes the same areas designated critical habitat in the 2001 final rule.

In determining which areas to designate as critical habitat, the Service considers those physical and biological features (primary constituent elements) that are essential to the conservation of the species, and that may require special management considerations and protection (50 CFR § 424.14). The Service lists the known primary constituent elements together with the proposed critical habitat description. Such physical and biological features include, but are not limited to, space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing (or development) of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

Due to the complex life history and dispersal capabilities of the California red-legged frog, and the dynamic nature of the environments in which they are found, the primary constituent elements described below are found throughout the watersheds that are proposed as critical habitat. Special management, such as habitat rehabilitation efforts (e.g., removal of non-native predators), may be necessary in the area designated. The proposed critical habitat for the

California red-legged frog provides for breeding and non-breeding habitats and for dispersal between these habitats, as well as allowing for expansion of frog populations vital to the recovery of the subspecies. The proposed critical habitat includes: (a) essential aquatic habitat; (b) associated uplands; and (c) dispersal habitat connecting essential aquatic habitat.
Aquatic habitat is essential for providing space, food, and cover, necessary to sustain all life stages of the California red-legged frog. It consists of virtually all low-gradient fresh water bodies, including natural and man-made (e.g., stock) ponds, backwaters within streams and creeks, marshes, lagoons, and dune ponds, except deep lacustrine water habitat (*e.g.*, deep lakes and reservoirs 50 acres or larger in size) inhabited by nonnative predators. The subspecies requires a permanent water source to ensure that aquatic habitat is available year-round. Permanent water sources can include, but are not limited to, ponds, perennial creeks, permanent plunge pools within intermittent creeks, seeps, and springs. Aquatic habitat used for breeding usually has a minimum deep water depth of 20 inches, and maintains water during the entire tadpole rearing season (at least March through July). During periods of drought, or less-than-average rainfall, these breeding sites may not hold water long enough for individuals to complete metamorphosis, but because they support breeding in wetter years these sites would still be considered essential breeding habitat. Ponds that support a small population of the California red-legged frog, but are not surrounded by suitable upland habitat, or are cut off from other breeding ponds or permanent water sources by impassable dispersal barriers, do not have the primary constituent elements for proposed California red-legged frog critical habitat.

To be a primary constituent element for California red-legged frog proposed critical habitat, the aquatic components within the designated boundaries must include two or more breeding sites (as defined above) located within 1.25 miles of each other; at least one of the breeding sites must also be a permanent water source; or, the aquatic component can consist of two or more seasonal breeding sites with a permanent non-breeding water source located within 1.25 miles of each breeding site. California red-legged frogs have been documented to travel 2.25 miles in a virtual straight line migration from non-breeding to breeding habitats (U. S. Fish and Wildlife Service 2001). In addition, breeding sites must be connected by dispersal habitat connecting essential aquatic habitat, described below.

Associated upland and riparian habitat is essential to maintain California red-legged frog populations associated with essential aquatic habitat. The associated uplands and riparian habitat provide food and shelter sites for California red-legged frogs, and assist in maintaining the integrity of aquatic sites by protecting them from disturbance and supporting the normal functions of the aquatic habitat. Key conditions include the timing, duration, and extent of water moving within the system, filtering capacity, and maintaining the habitat to favor red-legged frogs and discourage the colonization of nonnative species such as bullfrogs. Essential upland habitat consists of all upland areas within 300 feet, or no further than the watershed boundary, of the edge of the ordinary high-water mark of essential aquatic habitat (U. S. Fish and Wildlife Service 2001).

Essential dispersal habitat provides connectivity among California red-legged frog breeding habitat (and associated upland) patches. While frogs can pass many obstacles, and do not require a particular type of habitat for dispersal, the habitat connecting essential breeding locations and

other aquatic habitat must be free of barriers (e.g., a physical or biological feature that prevents frogs from dispersing beyond the feature) and at least 300 feet wide. Essential dispersal habitat consists of all upland and wetland habitat free of barriers that connects two or more patches of essential breeding habitat within 1.25 miles of one another. Dispersal barriers include heavily traveled roads (an average of 30 cars per hour from 10:00 p.m. to 4:00 a.m.) that possess no bridges or culverts; moderate to high density urban or industrial developments; and large reservoirs more than 50 acres in size. Agricultural lands such as row crops, orchards, vineyards, and pastures do not constitute barriers to California red-legged frog dispersal.

Point Reyes National Seashore and the Golden Gate National Recreation Area occur within the proposed Point Reyes Unit (Unit 12), which consists of watersheds within and adjacent to Bolinas Lagoon, Point Reyes, and Tomales Bay in Marin and Sonoma counties. This proposed unit encompasses approximately 200,572 acres; 44 percent is managed by the National Park Service, California Department of Parks and Recreation, and the Marin Municipal Water District, and 56 percent is privately owned. The proposed Unit 12 is known to be occupied by several populations of the California red-legged frog. Essential breeding habitat is dispersed throughout the proposed unit. This proposed unit contains one of the largest known populations of the California red-legged frog.

Mission Blue Butterfly

The mission blue butterfly was listed as endangered in 1976 (U.S. Fish and Wildlife Service 1976). Critical habitat was proposed in 1977 (U.S. Fish and Wildlife Service 1977) but was later withdrawn (U.S. Fish and Wildlife Service 1978).

The mission blue butterfly was described by Hovanitz in 1937 based on specimens collected at Twin Peaks in San Francisco. The animal has not been observed at that location in a number of years. The butterfly inhabits grasslands and coastal shrub in southern Marin, San Francisco, and San Mateo counties in California that contain one or all three of its larvae foodplants (*Lupinus albifrons*, *L. formosus*, and *L. variicolor*).

The wingspan of the adult mission blue butterfly is about an inch. The uppersides of the wings of the males are bright blue with white margins; the undersides are pale grey with two rows of irregular white-ringed black spots. The upperside of the wings of the female are brown, usually with a flush of blue scales at the base of the forewing.

The mission blue butterfly is univoltine and has a flight period that extends from late March to mid-June. On San Bruno Mountain, discrete populations of the animal near the mountain's peak and on the western and southern-facing slopes generally are the first to emerge each year (U.S. Fish and Wildlife Service 1984). These are followed by populations on the Northeast Ridge and the main ridge. Mission blue butterflies in Owl and Buckeye canyons are the last to emerge, perhaps due to their northern exposure and intermittent creeks which keep these areas cooler and more moist than other areas of San Bruno Mountain.

After they have mated, the females lay their eggs throughout their flight period. Single eggs are deposited on the leaves, stems, flowers, and seed pods of the *Lupinus* foodplants. The eggs are green overlaid by white papillae of the chorion (Comstock and Dammers 1935). The majority of eggs are laid on new growth, primarily the upper surfaces of the leaflets (U.S. Fish and Wildlife Service 1984) and they hatch in about 4-10 days (Downey 1957; Guppy and Shepard 2001; U.S. Fish and Wildlife Service 1984). The mature larvae are reddish purple or green with three purple or inconspicuous diagonal white lines on each body segment and the body is covered with short white hairs (Layberry *et al.* 1998; Guppy and Shepard 2001). The first and second instar larvae feed on the mesophyll of the *Lupinus* foodplant. About three weeks after eclosion, the second instar larvae begin an obligate diapause; most diapause in the leaf litter at the base of the foodplants. The following spring, the larvae break diapause and resume feeding. Cessation of diapause varies widely, even among sibling larvae. Under laboratory conditions, this period may be as great as one month. This protracted cessation of diapause and the variation in microclimate is why newly emerged adults can be observed throughout the 8-10 week flight period. The last instar larvae pupate on or near the base of the *Lupinus* foodplant rather than in the ground or in ant nests as suggested by Downey (1957). The pupal stage lasts approximately three weeks (Guppy and Shepard 2001). The pupa is green, and the abdomen is green or reddish-brown with green blotches (Scott 1986; Guppy and Shepard 2001).

The mission blue butterfly is a facultative myrmecophile; presumably specific ant species protect the larvae from parasites, parasitoids, and predators in return for honeydew secreted from special glands on the caterpillars' bodies. Downey (1962a) recorded 11 species of ants that tended Boisduval's blue butterfly (*Icaricia icarioides*), of which the mission blue butterfly is a subspecies. Third and fourth instar larvae are tended by ants, primarily *Prenolepis imparis* (U.S. Fish and Wildlife Service 1984). Downey (1957) found that the ant *Formica lasioides* tended the mission blue butterfly on Twin Peaks. Howe (1975) stated that larvae of the mission blue butterfly may sometimes be found on leaves or in the lupine blossoms by looking for the more conspicuous ants in attendance. Ants may construct chambers at the base of the foodplants just beneath the surface of the soil for access to the resting larvae, as diurnal resting places for the larvae, or both (Howe 1975).

In one study, 35 percent of field collected eggs of the mission blue butterfly were parasitized by an unidentified species of encyrtid wasp (U.S. Fish and Wildlife Service 1984; Downey (1962b) recorded parasitic wasps of the genus *Trichogramma* as an egg parasite from 50% of the 53 populations that he examined of Boisduval's blue butterfly. Third and fourth instar larvae were parasitized by a tachnid fly or braconid wasp. According to Howe (1975), there is a high incidence of parasitism in mature larvae of Boisduval's blue butterfly located on the foodplants during the daytime; he stated that healthy larvae tend to be nocturnal feeders. Rodents also may prey on the early stages (U.S. Fish and Wildlife Service 1984).

The grassland and to a lesser degree the coastal scrub habitat are disclimax communities. That is, maintenance and regeneration of the plants characteristic of these ecosystems are dependent upon irregular perturbation process that preclude normal succession. The *Lupinus* foodplants are dependent upon natural disturbance processes, such as rockslides, mudslides and fires to establish their seedlings. Thus, the survival and recovery of the mission blue butterfly requires

not only sufficient tracts of natural habitat, but also maintenance of the natural disturbance factors.

One of the most significant threats to the listed butterfly is loss of habitat due to succession and invasive exotic plant species. Ecosystems are dynamic, fluctuating through time in structure, composition and areal extent. Dynamics are initiated by environmental fluctuation, natural disturbance, species senescence or other intra-community characteristics. The *Lupinus* foodplants of the mission blue butterfly are dependent upon natural perturbations to establish seedlings. Under natural conditions, adults of the mission blue butterfly are widely distributed at relatively low densities. *Lupinus albifrons*, *L. formosus*, and *L. variicolor* also are widely distributed at low densities. These three plants are "pioneer" species (i.e., they grow best in areas of recent localized disturbance or in early stages of grassland succession). Patchily distributed dense colonies of these *Lupinus* are found at sites of natural disturbance, such as rodent burrows, mudslides, rock slides, fire, etc throughout the grassland. These colonies eventually senesce as other successional plants and weeds invade these sites, unless an irregular disturbance regime occurs that allows the *Lupinus* to propagate.

Non-native grasses and forbs that have invaded California grasslands are a serious threat to the mission blue butterfly due to their ability to become more abundant at the expense of the animal's larval foodplants and adult nectar sources. European annual grasses and forbs have displaced native forbs in native California grasslands, and in turn, have contributed to the decline of the mission blue butterfly (Biswell 1956; Murphy and Ehrlich 1989). This invasion was facilitated by widespread and intensive grazing (Fleischner 1994). Some of the exotic grasses that have invaded grasslands of the San Francisco Bay area are Italian ryegrass (*Lolium multiflorum*), slener oats (*Avena barbata*), ripgut (*Bromus diandrus*), red brome (*B. madritensis rubens*), and softchess (*B. hordaceus*). Some of the exotic forbs that have invaded these grasslands are Italian thistle (*Carduus pycnocephalus*), star thistle (*Centaurea solstitialis*), bull thistle (*Cirsium vulgare*), ehrharta (*Ehrharta erecta*), filaree (*Erodium* spp.), cat's ears (*Hypochaeris radicata*), burclover (*Medicago polymorpha*), yellow oxalis (*Oxalis pes-capra*es), plantain (*Plantago lanceolata*), sheep sorel (*Rumex acetosella*), blessed milk thistle (*Silybum marianum*), and mustards (*Brassica* and *Sisymbrium* spp.) (Amme 2002). Although many exotic forbs are used by the mission blue butterfly as nectar sources, they outcompete and replace native nectar plants, and replace their larval foodplants. A number of shrub species have also invaded grassland habitats in the Bay Area over the past 40 years. These include gorse (*Ulex europaeus*), various brooms (*Genista monspessulana* and *Cytisus scoparius*), and even native shrubs. For example, gorse increased in acreage 140 percent from 1972 to 1986 on San Bruno Mountain (Thomas Reid Associates 1987). Shrubs shade out native grassland forbs and grasses, including the lupine foodplants of the mission blue butterfly. Some California grasslands are subject to reversion to shrubland habitats in the absence of a mechanism to prevent it. Fire and grazing may reverse shrub invasion. While exotic grasses, forbs, and shrubs have displaced the three *Lupinus* species, and various nectar sources from grasslands, some exotic trees have created forests that have replaced the grassland ecosystem inhabited by the mission blue butterfly. For instance, forests of gum trees = eucalyptus (*Eucalyptus* spp.) at San Bruno Mountain have displaced grassland habitat that likely were used by this species

There are recent records of the mission blue butterfly within the portions of the proposed project located in Marin and San Mateo counties (California Department of Fish and Game 2004). Suitable habitat containing the larval foodplants and adult nectar sources are found in and adjacent to the action area. Therefore, the Service believes that the mission blue butterfly is reasonably certain to occur within the action area because of the biology and ecology of the animal, the presence of suitable habitat in and adjacent to the action area, as well as the recent observations of this listed species.

San Francisco Garter Snake

The San Francisco garter snake was listed as endangered in 1967 under the Endangered Species Conservation Act (U.S. Bureau of Sport Fisheries and Wildlife 1967), prior to the passage of the Endangered Species Act, and it was included when that Act was signed into law in 1973. The San Francisco garter snake was listed as endangered by the State of California in 1971.

The San Francisco garter snake has distinctive alternating longitudinal red, black, green, and blue stripes. The diagnostic character is the longitudinal lateral red stripe that separates two black stripes and, except anteriorly in some individuals, lacks ventral extensions (Barry 1994, 2005). The top of the head is red and the underside of the body is a rich turquoise blue. The adult females are larger than the males, up to 36 inches, as opposed to a length of 28 inches for the adult males.

The *San Francisco garter snake recovery plan* identified threats to the species as loss of habitat from agricultural, commercial and urban development, and collection by reptile collectors (U.S.. Fish and Wildlife Service 1985). Other threats include: (1) The California red-legged frog, the primary prey for the San Francisco garter snake, is in decline, and this amphibian faces several threats; (2) introduction of bullfrogs which may feed on both the San Francisco garter snake and California red-legged frog; (3) possible hybridization and outcrossing; and (4) seral succession of the remaining breeding habitat to the level that much of it has become unsuitable for the species.

The San Francisco garter snake is found only in San Mateo County on the San Francisco peninsula (Barry 1994, undated; U.S. Fish and Wildlife Service 1985). Fox (1951) and Barry (1994) stated the distribution of species is the western portion of the San Francisco peninsula from about the San Francisco County line south along the crest of the peninsula hills to at least Crystal Lake and along the coast west of this region to Point Año Nuevo. The *San Francisco Garter Snake Recovery Plan* identified six significant populations of this animal. These are located at the West-of-Bayshore adjacent to the San Francisco International Airport, the San Francisco State Fish and Game Refuge and associated San Francisco Water Department lands, Laguna Salada in the City of Pacifica, Pescadero Marsh Natural Preserve, Año Nuevo State Reserve, and a north of the Town of Half Moon Bay.

Barry (1994) reported that the San Franciso garter snake apparently was abundant in the sag ponds that existed where the current Skyline Boulevard was constructed in northern San Mateo County. Sag ponds are waterbodies that resulted where fault activity had impounded springflow

or runoff in an enclosed depression. Barry (1994) reported that in 1966, "dozens" of San Francisco garter snakes were captured and transplanted from these soon to be destroyed sag ponds to Point Reyes National Seashore in Marin County, and various other unrecorded locations in San Mateo County. It is believed that the animals did not survive at Point Reyes National Seashore, however, the status of the other translocations remains unknown (S. Barry pers. comm. to C. D. Nagano).

There are two significant components to San Francisco garter snake habitat: 1) ponds that support the California red-legged frog, bullfrogs, and the Pacific treefrog and 2) the surrounding upland that supports the Botta's pocket gopher (*Thomomys bottae*) and the California meadow vole (*Microtus californicus*). Ranid frogs are an obligate component of the San Francisco garter snake's diet (Barry undated, 1994, 2005, pers. comm. to C.D. Nagano). Barry (1994) noted that scattered, as opposed to dense brush was preferred basking habitat for San Francisco garter snakes.

This species is extremely shy, difficult to locate and capture, and quick to flee to water or cover when disturbed. Adult garter snakes may seek cover in rodent burrows during summer months when ponds become dry. Along the coast, snakes hibernate during the winter, but further inland, if the weather is suitable, garter snakes may be active year-round (U.S. Fish and Wildlife Service 1985; Wharton *et al.* 1989; Barry 1994). Information on seasonal movements of the species is scant (U.S. Fish and Wildlife Service 1985; Barry 1994, undated). However, it is known that some adults may spend considerable time near the hibernacula site after emergence from it. For example, they have been recorded breeding at entrances to these burrows shortly after emergence from hibernation (Keel, pers. comm.), and may spend the majority of each day during the active season in or near the same burrows. Breeding occurs in the spring or late fall and the snake bears live young from May through October; average litter size is about 12-18 (McGinnis 1988; Barry 1994; Stebbins 1985). Although primarily a diurnal species, captive snakes housed in an outside enclosure have been observed foraging at night on warm evenings.

Wharton (undated) and Wharton *et al.* (1989) reported that at the West of Bayshore property, the San Francisco garter snake emerged from hibernation during early March and their activity reached a peak in May. In June, their activity substantially dropped and then remained relatively stable through the summer months. In September, the activity of the San Francisco garter snake again dropped and remained low throughout the fall. They found almost no activity during the winter, except for brief periods on sunny days.

A seasonal shift in the distribution of the San Francisco garter snake between South Lomita Canal and Cupid Row Canal and the ephemeral marshes was observed at the West of Bayshore property (Wharton undated; Wharton *et al.* 1989). Throughout the winter, the listed reptile only occurred along the canals, apparently hibernating in rodent burrows on the high ground surrounding the canals. The exact location and nature of the overwintering sites remains undetermined. One local resident reported finding a dozen San Francisco garter snakes and "other snakes" in a rodent burrow at the top of the levee above South Lomita Canal during January or February of 1985 (Wharton undated; Wharton *et al.* 1989). It is possible that the San

Francisco garter snake, like other subspecies of *Thamnophis sirtalis* overwinters in communal dens (Fitch 1965; Alesiuk and Gregory 1974).

According to Wharton (undated) and Wharton *et al.* (1989), San Francisco garter snakes remained along the canals until early March when they began to utilize the ephemeral marshes; the females arrived at the marshes before the males. Although the reasons for his in unclear, the study by Gregory (1974) suggests an explanation. In Manitoba, Canada, male red-sided garter snakes (*Thamnophis parietalis*) emerge in the spring before the females and remain near the dens. When a females emerges, she is courted by the males and breeding occurs at that time. The females then move away from the den to the summer feeding range. Males stay near the dens until all the females have emerged and dispersed, at that time, the males move to a summer feeding range. Wharton (undated) and Wharton *et al.* (1989) hypothesized that a similar pattern of behavior may occur in the San Francisco garter snake. The males emerge first, remain near the canals, and then court and mate with the females as they emerge from their hibernation sites. After mating, the females then move to the ephemeral marshes; male dispersal probably occurs after the females have left the canals.

The San Francisco garter snake population at the West of Bayshore property was concentrated at the marshes until June at which time these wetlands dried out (Wharton undated; Wharton *et al.* 1989). As the sightings decreased in the marshes, there was a corresponding increase at the canals. The females returned to the canals before the males. The earlier return of the females may be due to the timing of parturition. Parturition probably occurs in late spring or early summer at the canals based on the presence of gravid females. Throughout the summer and fall, the animals were concentrated along the canals, however, in October, an occasional San Francisco garter snake was observed 50-100 feet from a canal, apparently searching for an overwintering site.

Adult San Francisco garter snakes primarily feed on California red-legged frogs, bullfrogs and Pacific treefrogs (Barry 1994, 2005, undated), although at the West of Bayshore property, a small number of the reptiles were observed to have fed on three-spined sticklebacks (*Gasterosteus aculeatus*), mosquito fish (*Gambusia affinis*), dead rodents (*Microtus* species), earthworms, leeches, pond snails, and a western toad (*Bufo boreas*)(Wharton undated; Wharton *et al.* 1989) . The food eaten by the San Francisco garter snake at the West of Bayshore property changed seasonally and appeared to be based on the availability of the prey. In early spring, when the listed reptiles emerged from hibernation along the canals and began to disperse to the marshes, Pacific tree frogs and California red-legged frogs constituted the primary food sources. During the spring season, when the reptiles occurred throughout the marshes, Pacific tree frog tadpoles were taken in great numbers. The tadpoles were available as a food source in late spring, when they were trapped in small pools as the marshes dried out. During the summer, after the San Francisco garter snakes returned to the canals, California red-legged frogs and their tadpoles provided the main food items. California red-legged frog tadpoles were highly vulnerable to predation during the spring when they were metamorphosing. The San Francisco garter snakes would hide or lie on floating vegetation in the canals and when the tadpoles swam to the surface of the water, they were captured, taken to the bank of the canal, and then consumed.

In the marshes of the West of Bayshore property, sticklebacks were taken by adult San Francisco garter snakes during the spring, and by newborn snakes in the southwestern portion of Cupid Row Canal during the fall (Wharton undated; Wharton *et al.* 1989). However, Wharton (undated) captured three San Francisco garter snakes with sticklebacks wedged in their mouths, and the spines of the fishes were impaled in the snakes' jaws. Although 64 sticklebacks or 7% of the snakes examined had eaten these fish, he hypothesized that *Gasterosteus aculeatus* were eaten incidentally while the reptiles were foraging in shallow water for tadpoles, or when no other preferred food sources were available.

With respect to the feeding habitats of the San Francisco garter snake at the West of Bayshore property, the ephemeral marshes were considered by Wharton (undated) and Wharton *et al.* (1989). Although the listed reptiles only spend two to three months each year in these areas, relatively more feeding occurred during these times than any other time of the year. Gravid female San Francisco garter snakes were captured in the greatest number in the areas around these wetlands. The ephemeral marshes also are the primary breeding site for the Pacific tree frog and the tadpoles of this amphibian comprised over 75% of the snakes' diet.

Barry (2005, pers. comm. to C. Nagano) stated that one method of determining the potential presence of the San Francisco garter snake at a site is to complete surveys for ranid frogs, e.g., the California red-legged frog and the bullfrog. Both of these frog species are used as food source by the listed reptile (Barry 2005).

Female San Francisco garter snakes exhibit a high level of site fidelity (McGinnis 1989; McGinnis *et al.* 1987), particularly to the burrow they use for aestivation and hibernation. Females can be found daily at the entrance to their burrow, and travel to the wetland one to two times per day (Paul Keel, pers. comm.) The aestivation burrow also is where females hibernate. The mean distance of female hibernacula to the Visitor Center Pond at Año Nuevo State Reserve was 459 feet, with a maximum distance of 637 feet. Distances of greater than 637 feet have been reported, including an unconfirmed distance of approximately 1000 feet. Though there are periods of time that a female will not be found at the burrow, such as during treefrog metamorphosis and dispersal, the majority of females have been observed in the vicinity of burrows in consecutive survey years (McGinnis *et al.* 1989).

McGinnis reported low survivorship of juvenile San Francisco garter snakes. In areas where other species of garter snake are present, and where Western yellow-bellied racers (*Coluber constrictor mormon*) are present, recruitment of San Francisco garter snakes is almost non-existent. Having up to three species of garter snake to forage on, each with different life histories and birthing periods, may enhance the yellow-bellied racer population. This, in conjunction with overlap of yellow-bellied racer foraging and the San Francisco garter snake juvenile dispersal period, may subject juvenile San Francisco garter snakes to higher predation pressure than other garter snakes. Therefore, low survivorship of juvenile San Francisco garter snakes could be from increased predation from yellow-bellied racers, increased competition from other garter snakes, or a combination of increased predation and competition.

The species has been extirpated from most of its historical distribution in the Skyline Boulevard area of San Mateo County. Fox (1951) reported typical populations of the snake on the coast around Sharp Park Golf Course at the Laguna Salada, and along Skyline Boulevard. Since then, the sag ponds along Skyline Boulevard have been drained and filled for urban development and the Sharp Park area has been severely impacted by residential and golf course development. In 1987, the seawall at Sharp Park failed, allowing the intrusion of salt water into Laguna Salada. However, in 2004, a trapping survey conducted at Sharp Park Golf Course and Mori Point (owned by the National Park Service) documented seven San Francisco garter snakes, and an individual was killed by a lawn mover in 2005. The seven snakes were trapped near Horse Stable Pond on the golf course, near Laguna Salada on golf course property, and near a wetland on Mori Point.

In 1989, abandoned quarry ponds adjacent to Calera Creek, over the ridge from Sharp Park, were found to support a small population of snakes. These snakes may have migrated from Laguna Salada after the failure of the sea wall. In August 1989, the quarry ponds were illegally drained and filled. The current population status at the quarry ponds is unknown. In 1985, the population at Año Nuevo State Reserve was thought to be stable at fewer than 50 snakes, but in 1995 the population appeared to be declining (Paul Keel, pers. comm.). This decline may be caused by inadequate management for the San Francisco garter snake and the recent introduction of bullfrogs.

There are recent records of the San Francisco garter snake within the portions of the proposed project located in San Mateo County (California Department of Fish and Game 2004). Suitable habitat for foraging, mating, sunning, and aestivation is found in and adjacent to the action area. Barry (pers. comm.) noted that extremely low density populations of this endangered snake may persist in extremely small areas. Therefore, the Service believes that the San Francisco garter snake is reasonably certain to occur within the action area because of the biology and ecology of the animal, the presence of suitable habitat in and adjacent to the action area, as well as the recent observations of this listed species.

Raven's Manzanita

Raven's manzanita was listed as endangered in 1979 (U.S. Fish and Wildlife Service 1979). A detailed account of the taxonomy, ecology, and biology of this species is presented in the *Raven's manzanita Recovery Plan* (U.S. Fish and Wildlife Service 1984) and the *Draft Recovery Plan for Coastal Plants of the Northern San Francisco Peninsula* (U.S. Fish and Wildlife Service 2002).

Raven's manzanita is a prostrate to ascending evergreen shrub in the heath family (Ericaceae). It was reported to grow less than 2 feet tall in historic inland localities (U.S. Fish and Wildlife Service 1984), but the single wild plant today grows nearly prostrate on an exposed coastal site. Raven's manzanita lacks burls (lignotubers), specialized flattened trunk-like structures which are adapted to rapid vegetative regeneration following fires. Its leathery, evergreen, round to round-elliptic leaves are 0.3 to 0.7 inch long, and are isofacial (have the same type of surface on both sides). Flowers are urn-shaped to round, with five-lobed white to pinkish corollas about 0.25 inch long, with ovaries (floral precursors of fruits containing undeveloped seeds) lacking

pubescence (Wells 1993). Flowers appear from midwinter (in mild winters) to mid-spring (U.S. Fish and Wildlife Service 1984). Fruits are tan or brownish, round and berry-like with thick pulp, containing 2 to 10 stony seeds. The flower stalks are densely covered with fine woolly hairs. Prostrate stems in prolonged contact with the ground are reported to develop roots (U.S. Fish and Wildlife Service 1984). Key distinguishing characteristics of this taxon, based on the single surviving individual plant, are the combination of prostrate juvenile growth habit, the round to round-elliptic isofacial leaves, and the small flowers and fruits (Wells 1993).In the current taxonomic treatment of California manzanitas (Wells 1993),

Only a single natural clonal colony of Raven's manzanita remains on an ocean-facing serpentine bedrock outcrop within a larger serpentine soil area near Baker Beach in the Presidio. All other populations in San Francisco have been extirpated. The clonal colony, rediscovered around 1950, is probably well over a century old (Raven 1952). This population of one plant has been augmented by planting artificially propagated genetically identical daughter clones of the mother plant in its vicinity. Additional genetically identical populations have been established by transplanting clonally propagated (rooted cuttings) plants in the general vicinity of this site at three nearby locations. A clone has also been planted at another serpentine outcrop in the Presidio, off Arguello Boulevard. This same clone has also been maintained in cultivated populations in San Francisco and Berkeley. Unlike Franciscan manzanita, no plants of Raven's manzanita were salvaged from former interior San Francisco localities before they were destroyed by urban development. Raven's manzanitas at interior sites may not have attracted conservation attention because they were once considered to be atypical forms of Franciscan manzanita (Roof 1976).

Historic San Francisco manzanita localities that supported both Franciscan manzanita and Raven's manzanita included: (1) the former Laurel Hill Cemetery; (2) the former Masonic Cemetery (near Lone Mountain; the "base of Lone Mountain" locality of "*Arctostaphylos pumila* Nutt." reported by Greene (1894) may have been the Masonic Cemetery locality or a nearby population); (3) Mount Davidson, in the south-central part of the City; and (4) the Presidio locality still surviving. In addition, there is a record of "*Arctostaphylos pumila*" (Behr 1892; a misnomer for either Franciscan or Raven's manzanita, or perhaps both) at the former Protestant Orphan Asylum (Laguna at Haight Street, long urbanized in the late 1800's). Nearly all historic localities of creeping manzanitas in San Francisco were outcrops of serpentine (all sites except Mount Davidson, which comprises greenstone and mixed Franciscan rocks), which suggests limited historic and prehistoric distribution and only local abundance. Evidence for historic mixed populations consists of inadvertent inclusions of Raven's manzanita material within herbarium collections of Franciscan manzanita and direct observations of co-occurrence (Roof 1976, U.S. Fish and Wildlife Service 1984). Otherwise, definitive historic records and surveys of Raven's manzanita are lacking because it was not recognized as distinct from Franciscan manzanita until long after all but one of its populations were extirpated.

It is possible that the limited historic records under-sampled and under- represented the early historic abundance and distribution of Raven's manzanita. Many collectors of Franciscan manzanita may have consciously or unconsciously selected material most similar to the type of this taxon (Roof 1976), which could have biased the sampling of specimens. Behr (1892)

described "*Arctostaphylos pumila*" (not the species endemic to sandy soils near Monterey, but the "creeping manzanita" of Brandegee's San Francisco flora of 1894) as "once abundant" in his botanical memoirs of San Francisco in the 1850's, and predicted its extirpation there nearly a century ago. It is unknown how many populations of San Franciscan manzanitas (mixed Raven's and Franciscan manzanita) occurred during and prior to the 1850's. Herbarium collections of manzanitas in San Francisco were made in the 20th century, after urbanization was well advanced in much of the City.

Generally, available data suggest that Raven's manzanita is a slow-growing, stress-tolerant evergreen shrub which is able to grow on serpentine soils with sparse competing vegetation, but like many manzanitas (Gottlieb 1968; Kruckeberg 1977), is relatively intolerant of competition (especially shading from shrub or tree canopies). It appears to have been locally abundant (Behr 1892) in relatively isolated, localized open serpentinite outcrop colonies, determined by structural geology of the local landscape.

Raven's manzanita has been successfully cultivated for many years under non-serpentine, irrigated garden soil conditions without growth abnormalities or indications of nutrient deficiencies at Tilden Park in Berkeley, California and the Berkeley Botanical Gardens at the University of California, and the Strybing Arboretum in San Francisco, California (McCarten 1986). The successful growth of Raven's manzanita and related taxa on non-serpentine substrates at multiple locations indicates that they have no specific physiological (nutritional) requirement for serpentine soil chemistry per se.

Climate and environment affect growth and form of Raven's manzanita. High rainfall appears to promote incidence of twig blight, but also appears to support luxuriant growth later in the growing season (P. Baye unpublished data 1997 to 1998). Some plants from extirpated populations in sheltered conditions apparently developed a more ascending to erect, but low, growth habit compared with wind-flagged plants on exposed bluffs (U.S. Fish and Wildlife Service 1984). Mature clones of the Presidio Raven's manzanita growing at Tilden Botanical Gardens in warmer, sheltered inland conditions remain strongly prostrate, indicating a strong genetic component to the growth habit of the lone individual from the exposed coastal site (P. Baye, pers. observ. 1998). Prostrate habit may also sometimes be partly a juvenile trait.

There are no scientific data on the breeding system of Raven's manzanita, and available evidence is unclear. Raven's manzanita has been reported to be an obligate outcrosser (M. Parker, pers. comm. cited in McCarten 1986), a cross-fertilizing species unable to produce significant amounts of viable seed from self-pollination. Obligate outcrossing plants require more than one genetically compatible individual to reproduce sexually. The remaining isolated Raven's manzanita in the Presidio, however, has been observed to set seed spontaneously, which suggests either some degree of self-pollination or very long-distance hybrid cross-pollination. Cultivated and wild manzanitas alike readily hybridize among species (McMinn 1939; Wells 1968, 1991; Roof 1976; Ellstrand *et al.* 1987). The wild Raven's manzanita plant, however, is reported to produce few mature fruits and seed (U.S. Fish and Wildlife Service 1984). No fruits were produced on the Presidio remnant clone, or its daughter clones, in 1998 or 1999, despite abundant flowering and presence of bees during flowering (P. Baye, pers. observ. 1998-1999). In

contrast, both self-pollinated and open-pollinated Raven's manzanita in cultivation at the University of California, Berkeley, have been reported to produce abundant seed, with about 20 percent viability in both lots (40 percent of the fruits with at least one viable seed) in 1995 (H. Forbes, pers. comm. 1999).

There have been no reports of natural seedling establishment around the remnant wild Raven's manzanita or elsewhere since it was rediscovered in 1952. This may be due to a lack of viable seed, seed predation, or lack of sufficient seedling microsites in the undisturbed vegetation around the single natural plant, or possibly other factors. No data are available on the natural germination ecology of Raven's manzanita. Propagation of other California species of manzanita often requires moist-chilling, scarification (mechanical attrition) of seed coats, or treatments which mimic burns (Lenz 1956; U.S. Fish and Wildlife Service 1984). It is possible that seed germination of Raven's manzanita could be stimulated by burns (Keeley 1987), as in other manzanita taxa further south on the San Francisco Peninsula (McClintock *et al.* 1990). Tamalpais manzanita has been observed to regenerate from seed following fire (herbarium sheet annotation, *Eastwood 12980,* CAS 128697). Generally, seed germination of manzanitas is slow and erratic (Lenz 1956), traits consistent with persistent seed banks from which seedlings are recruited following disturbances (Thompson 1992). Naturally occurring dormant seed banks occur in other Californian manzanita species, both in fire-adapted species (post-burn resprouting manzanitas with woody burls rich in regeneration buds) or fire-sensitive species (regenerating only from seed after burns; Kelly and Parker 1990). However, most studies indicate that most seeds produced do not accumulate in soil seed banks, and many seeds are lost to predation (Kelly and Parker 1990).

The major cause of historic decline in Raven's manzanita populations was the irreversible elimination of its habitat by San Francisco's urban growth. The lack of seedling colonization of new habitat (possibly due to observed low reproductive output and poor dispersal to isolated patches of suitable seedling habitat) appears to have prevented it from overcoming the adverse effects of habitat loss and fragmentation. Current threats to its survival are partly due to inherent risks associated with the extreme reduction in population size to a single clone (genetic individual), and partly due to external threats. The external threats to the single Presidio individual that were described in the original recovery plan continue to some extent today, with the exception of shading by trees, which were removed about 1984. The small population of replicate clones on the Presidio is also vulnerable to fire, landslides, accidental injury by road maintenance or vegetation management activities, and vandalism (U.S. Fish and Wildlife Service 1984).

The principal contemporary threat to the persistence of the long-lived original clone of Raven's manzanita is competition (interception of light) by vegetation that overtops the prostrate plant (U.S. Fish and Wildlife Service 1984). The most significant potential competitors are trees that are not native to the San Francisco Peninsula which can overtop and shade the remnant wild manzanita clone: Monterey cypress (*Cupressus macrocarpa*), Monterey pine (*Pinus radiata*), and blue gum trees (*Eucalyptus globulus*). These trees have been removed from the immediate vicinity of the remnant clone (U.S. Fish and Wildlife Service 1984), but reinvasion from abundant local seed sources remains a threat. Other invasive non-native plants in the vicinity of

the Raven's manzanita site which represents potential competitive threats include iceplant (*Carpobrotus edulis* and its hybrids), myoporum (*Myoporum laetum*), plume acacia (*Albizia lophantha*), juvenile wattle (*Acacia* spp.), jubata grass or "pampas grass" (*Cortaderia jubata*), and non-native annual grasses. Of these, jubata grass is now among the most invasive species on serpentine bluffs, scarps, and landslides below the manzanita preserve site. It has proven to be highly invasive to disturbed sites, and produces abundant plumed seed capable of long-distance wind-dispersal. Although jubata grass abundance has recently been reduced on the bluffs, it recolonizes readily and can grow very rapidly even on serpentine soil (P. Baye, pers. observ. 1993 to 1999). One native shrub species, a prostrate form of blue-blossom (California-lilac, *Ceanothus thyrsiflorus)*, also competes with Raven's manzanita to some extent (U.S. Fish and Wildlife Service 1984), but has apparently coexisted with it for decades without causing progressive decline in the clone.

Ongoing rigorous vegetation management is needed to suppress reinvasion of non-native vegetation in the immediate vicinity of the preserved clone at the Presidio, and in the surrounding area which is a source of non-native plant seed. Reinvasion would remain a potential threat to the site even if contemporary invasion levels are low. Reducing the effort to suppress these invasive species, even temporarily, would probably enable them to recolonize the preservation site, and resume their threat to the manzanita clone.

In years of frequent and late rains, Raven's manzanita develops relatively extensive infections by a twig blight (called "black smut" in the original recovery plan; U.S. Fish and Wildlife Service 1984) which causes leaf necrosis (tissue death) and dieback of whole sectors of stems in winter and early spring (S. Farrell, pers. comm. 1998, as cited in Coastal Plan). Up to 40 percent of individual clones may suffer dieback in a mosaic pattern during winter months. Affected clones typically quickly recover from blight-induced dieback during the subsequent growing season. Recovery occurs mainly by overgrowth of dead sectors by vegetative shoots from adjacent portions of the clone in spring and early summer (P. Baye unpublished data 1997 to 1999, as cited in Coastal Plan). Twig blight is likely due to fungal pathogens such as *Phomopsis* spp., which affect other species of manzanita as well (Lenz 1956). Cultivated specimens of other native manzanitas at the Strybing Arboretum vary in susceptibility to twig blight in rainy years. At Strybing, the Raven's manzanita clone is relatively susceptible to blight, even compared with Franciscan manzanita. Cultivated clonal replicates of Raven's manzanita in the drier, warmer inland hills of Berkeley (Alameda County) exhibited no blight symptoms after several wet years (P. Baye, pers. observ. 1997 to 1998).

The long-term threat of fungal pathogens to the wild Raven's manzanita clone is uncertain, but the old age of the wild clone suggests that it is a short-term, cyclic effect, not a progressively degenerative problem. Fungal infection appears to be a greater potential threat to the survival of the smaller daughter clones, which have proportionally more necrotic area when infected. The former variability in pathogen resistance within the entire original population of Raven's manzanita is unknown. Natural genetic variability in pathogen resistance within populations is widespread among plant species (Burdon 1987), and some variation may have been lost with former extirpated populations of Raven's manzanita. Lack of adequate levels of genetic variability in pathogen resistance traits may make plant populations more susceptible to disease

outbreaks and increased mortality (Burdon 1987; Huenneke 1991). If more virulent strains of twig blight or other pathogens infest the population, dieback could imperil the single wild manzanita clone. Cumulative effects of infection or cumulative increases in inoculum potential (accumulation of diseased leaf litter, a source of spores for reinfection) could also threaten the single clone. Fungicidal treatment of infected plants, which are obligate mycorrhizal species, may be impractical.

Since the issuance of the 1984 recovery plan, the Golden Gate National Recreation Area and its volunteers significantly reduced competition by non-native vegetation around the natural Raven's manzanita clone, removing Monterey cypress, iceplant, and non-native grasses, and minimizing recolonization by these species. Symbolic fencing, interpretive signs, and improved coordination with road maintenance and other staff of the Golden Gate National Recreation Area have reduced threats of trampling and accidental damage. These actions have resulted in expansion of the clone in a generally healthy condition most years.

In January 1987, the Presidio, then managed by the U.S. Army, and the Golden Gate National Recreation Area cooperatively propagated 168 cuttings of the wild clone, from which 50 propagated plants survived to be planted in the Golden Gate National Recreation Area. This is a step toward, but far short of, the 1984 recovery plan's prescription for 5 populations of at least 20 plants each. Tilden Park and the University of California, Berkeley, have maintained their collections of both endemic San Francisco manzanita taxa. Strybing Arboretum has maintained a single replicate clone of Raven's manzanita, but it has declined precariously in recent years due to blight and high rainfall. University of California, Berkeley, obtained open-pollinated and self-pollinated seed from approximately 4,500 fruits harvested from cultivated clones in 1995 (H. Forbes, pers. comm. 1999, as cited in Coastal Plan), from which 12 seedlings from the open-pollinated source were obtained under experimental germination conditions.

The parent plants and the 12 surviving clones are on lands managed by the Presidio Trust in Area B of the Presidio. Six additional clones exist in Area A managed by the National Park Service.

San Francisco Lessingia

The San Francisco lessingia was listed as endangered in 1997 (U.S. Fish and Wildlife Service 1997). A detailed account of the taxonomy, ecology, and biology of this listed plant is presented in the *Draft Recovery Plan for Coastal Plants of the Northern San Francisco Peninsula* (Service 2002).

The San Francisco lessingia is an annual herb in the aster family (Asteraceae). Seedlings and young vegetative plants develop from unbranched rosettes of oblanceolate (spear-shaped but tapered at base, wide and rounded at tip) leaves. As the plant matures, some lateral shoots elongate markedly, and then branch profusely, developing a decumbent (growing mostly through lateral branches) growth habit. Mature plant heights can range from less than 2 inches in stunted plants to 1.2 feet tall. Mature stems are reddish brown and are tomentose (with loose grayish woolly hairs). Leaves on mature stems are small (0.2 to 1.2 inches), most less than 0.3 inch, pinnately lobed (branching from a single central vein), toothed or entire (lacking teeth and lobes),

oblanceolate or long-tapered obovate (egg-shaped, but widest at the far end), and grayish-green due to dense woolly hairs. Flowerheads appear in late summer through fall, and occur singly or in loose clusters at the ends of stems. Depending on plant size, individuals may bear a few to hundreds of flowerheads. The bell-shaped involucre (a mantle of tiny leaf-like appendages called phyllaries which enclose the immature flower head) is 0.15 to 0.3 inch wide. Phyllaries are lance-shaped, with abruptly pointed tips. All florets within the flowerhead are disk florets (composite flowers within the flowerhead); ray florets (small individual flowers with strap-shaped corollas resembling single petals at the margin of the flower head) are lacking. Each head contains from 20 to 40 disk florets. Each floret has a yellow corolla (series of petals which are united into a tubular to funnel-shaped deeply lobed structure), with brownish bands in the throat. The fruit is an achene (a seed-like dry fruit) 0.04 to 0.12 inch with tan or whitish pappus (hairy bristles that increase the dispersability of achenes in air currents). No other annual *Lessingia* species occur within the range of *Lessingia germanorum* on the San Francisco Peninsula, making it easy to distinguish (Howell 1929; Spence 1964; Lane 1993, as cited in Hickman 1993).

Seedlings emerge from late fall to spring, soon after periods of rainfall and increased near-surface sand moisture (Pogge 1998; J. Cannon, pers. comm. 1996, as cited in the *Draft Recovery Plan for Coastal Plants of the Northern San Francisco Peninsula*). There are two marked growth phases in development (Howell 1929). During the rainy season, seedlings develop into juveniles which develop as unbranched vegetative short plants, typically basal rosettes (relatively broad leaves on short erect stems with the growing tip near the ground). Around the end of the rainy season (mid- to late spring) the erect central shoot of the juvenile plants elongates, then branches profusely, producing smaller leaves. The plant develops a low, spreading, bushy growth habit in open conditions before it enters reproductive phase (Howell 1929; Pogge 1998). Branching continues repeatedly after flowering and seed set. Lateral shoots develop below individual flowerheads and seedheads, terminating in new clusters of flowerheads, which in turn develop more lateral shoots below them.

Flowerheads begin to form as early as May; unopened flowerheads are common in early summer. Flowers usually open beginning mid- to late summer, with abundant flowering in August-September, continuing through November (Howell 1929; Pogge 1998). Large plants in sparsely vegetated areas may produce many hundreds of flowerheads, each bearing up to 40 florets (potential seeds; Lane 1993, as cited in Hickman 1993), but actual average number of seeds per flower head is about 26 (Pogge 1998), implying that the largest individuals may produce up to 36,400 seeds. Individuals competing with dense non-native annual grasses may be very short and sparsely branched, with few or tens of flowerheads.

Pollination may be achieved by insects, or possibly by wind as well (Spence 1964). Pollen of *Lessingia* species is light and dry (Spence 1964) rather than heavy and sticky, as would be expected for flowers exclusively adapted to insect pollination (Faegri and van der Pijl 1979; Proctor *et al.* 1996). Some wind-pollinated grassland species are also pollinated by insects (Faegri and van der Pijl 1979). Spence (1964) failed to detect any indication of pollen transfer by insects in any wild populations of *Lessingia* species, even though potential pollinators (syrphid flies, which lacked detectable pollen traces on their bodies) were present. Other potential insect pollinators observed visiting *Lessingia germanorum* flowers include numerous moths and

butterflies, such as pyralid moths, skippers, ringlet butterflies, cabbage white butterflies (*Pieris rapae*), blue and hairstreak butterflies, and American lady butterflies (*Vanessa virginiensis*); flies; bees and wasps, including sphecid wasps, halictid bees, andrenid bees, bumblebees (*Bombus vosnesenskii*); mirid bugs; and weevils (A. Whelchel unpublished data 1998).

Ripe achenes (plumed "seeds") begin to disperse in September, and continue through late fall. Earliest achenes have been observed in late June (Pogge 1998). Achenes are primarily wind-dispersed, as indicated by their light weight, small size, and well-developed pappus (Spence 1964). Seed set of populations at the Presidio appears to be consistently high (P. Baye, pers. observ. 1996 to 1998, as cited in Coastal Plan). Seed dispersal distance has not been studied, but seedling distribution tends to be contagious around parent plants. Landscape barriers to dispersal, such as tree plantations, may be more significant barriers to dispersal than inherent dispersal ability of achenes. Seeds may also possibly be passively dispersed by humans, by adherence of seed to footwear or clothing (J. Cannon, pers. comm. 1997, as cited in Coastal Plan). While dispersal ability of the San Francisco lessingia may be low because of landscape and habitat constraints, its colonizing ability in suitable open or disturbed sandy vegetation gaps (*e.g.*, Hillside Park, Lobos Dunes, Wherry Dunes) appears to be quite strong.

In the 19th century, San Francisco lessingia was reported or collected from numerous unspecified localities and two specific areas in San Francisco: one in the northwest, from the Presidio (near Lobos Creek) to Lone Mountain, and one in the southwest, near Lake Merced (Brandegee 1892). Herbarium sheets with specific collection localities from the 19th and 20th centuries clearly indicate that the historic distribution of San Francisco lessingia on the San Francisco Peninsula was considerably wider than today. The modern distribution of this listed species is probably due to habitat loss, habitat alteration, and extirpation of populations (Spence 1964).

The San Francisco lessingia is currently known from one population at Hillside Park in Daly City and six sites at the Presidio. At the Presidio, each population is located from a few hundred to few thousand feet from the nearest neighboring population.

The Lobos (Creek) Dunes site is an area of early-succession stable dune scrub which was recently (1995 to 1997) restored by removal of non-native trees and replanting locally propagated native vegetation (J. Cannon, pers. comm. 1996, as cited in the *Draft Recovery Plan for Coastal Plants of the Northern San Francisco Peninsula*). This expanded the small (less than 0.5 acre) remnant Lobos Creek population which occurred on a formerly graded, disturbed, weedy, open space on mixed dune sand and fill substrates above Lobos Creek. The site is bordered by non-native Monterey cypress groves and Lobos Creek's riparian zone. The restored dune area supporting San Francisco lessingia now occupies approximately 13 acres. The rapid expansion of the San Francisco lessingia at this site reflects the early successional development of the restored vegetation there.

The Battery Caulfield Road site is a small dune scrub patch (1 acre) which was subjected to early (1988) restoration efforts by the Golden Gate Recreation Area. A planted Monterey cypress grove partially shades the site to the west and isolates it from Lobos Dunes. The site is heavily invaded by non-native grasses. It supports a moderate sized colony of San Francisco lessingia,

consisting mostly of small plants (P. Baye, pers. observ. 1996 to 1999, as cited in the *Draft Recovery Plan for Coastal Plants of the Northern San Francisco Peninsula*). This population is reintroduced, the product of seeding conducted in 1988 at the approximate location of a historic remnant colony (Golden Gate National Recreation Area unpublished data as cited in the *Draft Recovery Plan for Coastal Plants of the Northern San Francisco Peninsula*). The original colony was probably a subpopulation or daughter colony of the population at the adjacent Lobos Creek site, from which it was severed by the Monterey cypress grove that today covers many acres of a high, west-facing intact dune slope.

The Marine Hospital site is northeast of the former Marine Hospital is a disturbed remnant stable dune with coast live oak (*Quercus agrifolia*), native and non-native grassland, and dune scrub vegetation consisting mostly mock-heather (*Ericameria ericoides*), and coyote-brush. Part of this site had been disturbed by earthmoving activities (a borrow pit for sand and haul road) and trampling, which may have provided or expanded open sandy habitat for the San Francisco lessingia here in the past. The site is bordered by a strip of Monterey pine to the south and a strip of blue gum trees to the east. These tree plantings function as wind-breaks and visual barriers for the adjacent Presidio golf course. San Francisco lessingia is most often associated here with partially bare erosional slopes, remnants of vehicle and pedestrian tracks, annual-dominated sandy flats, and edges of active pedestrian paths along fences — all microsites where vegetation is either low, open, or sparse. The site, now fenced and relatively undisturbed, shows indications of succession towards closed perennial and woody native dune scrub vegetation, as well as colonization by some oak seedlings (P. Baye unpublished data 1998). An undisturbed grove of native oak woodland and dune scrub borders the west end of the San Francisco lessingia population. A formerly excavated/graded/filled dune area supporting mixed wet meadow and dune slack vegetation such as salt rush (*Juncus lesueurii)* and Pacific blackberry, dune scrub consisting mostly coyote-brush, and iceplant occurs to the north and northwest.

The Presidio Golf Course roadside site is a narrow, steep road cut in old dunes on the west side of the maintenance road adjacent to the Presidio Golf Course, across the golf course from the Marine Hospital San Francisco lessingia site. This area, which covers less than 1 acre, is a gap in the narrow stand of blue gum trees which otherwise line the top of the cut and borders the golf course. The steep slope undergoes small-scale chronic erosion, and supports a moderate to small population of the San Francisco lessingia in the vegetation gaps. Dominant vegetation comprises typical native dune scrub dominants, non-native grasses, primarily *Briza* sp., and bracken fern (*Pteridium aquilinum*) (P. Baye unpublished data 1998). The site is bounded by the maintenance road, the Golf Course, and blue gum stands, and is parallel to Highway 1. The population here is located near Mountain Lake, a historic extirpated locality of San Francisco lessingia.

The Rob Hill site is a patch of disturbed, weedy old dune scrub and grassland at the edge of a eucalyptus grove, and adjacent to Battery McKinnon-Stotsenberg. It supports a population of San Francisco lessingia ranging in the thousands of plants. The portion of the site supporting locally abundant dune annuals and San Francisco lessingia covers about 1 acre. The site is bounded by a dense grove of blue gum, an evergreen understory of Canary Island ivy (*Hedera canariensis*), and historic military buildings.

The Wherry Dunes restoration site is a 10-acre restoration site above the north end of Baker Beach near Battery Chamberlain, located upslope of Lincoln Boulevard at the north end of Pershing Drive. This site of demolished buildings has been planted with native dune scrub vegetation, and a small, volatile founder population of San Francisco lessingia has recently established spontaneously. Above the Wherry Housing area is an undeveloped site ("Feral dunes") with vegetation composed of remnant dune scrub, primarily coyote brush, and grassland. This dune scrub site also supported a transient colony of three pioneer plants of San Francisco lessingia in 1997 (Golden Gate National Recreation Area unpublished data 1998 as cited in the *Draft Recovery Plan for Coastal Plants of the Northern San Francisco Peninsula*). The Lobos (Creek) Dunes site is within Area A managed by the National Park Service. The remaining five sites are in Area B of the Presidio managed by the Presidio Trust.

Habitat loss and adverse alteration of ecological processes are the principal historic causes of decline of San Francisco lessingia. The resulting small numbers and localized distribution of the species have in themselves become a primary threat to survival because of the amplified risk of extinction through random catastrophic events or progressive vegetation change.

The essential ecological processes which have been lost in San Francisco dune vegetation are unimpeded transport of sand from beaches and mobile dune complexes, and natural disturbances at both large and small scales that controlled vegetation gap dynamics. Other essential ecological and geomorphic properties of the San Francisco dune system which have been lost or diminished significantly include variation in dune topography that controls windflow patterns and intensity (Olson 1958); burial and rejuvenation of stabilized dunes and dune slacks (wet depressions) by mobile dunes; wind erosion and sand transport in dune blowouts; and sand slope adjustment in eroding dune scarps (Jungerius *et al.* 1981; Carter 1988; Gares and Nordstrom 1990; Fraser *et al.* 1998).

The secondary cause of decline, and the most important short-term threat to survival of San Francisco lessingia, is habitat change caused mainly by the spread of invasive non-native vegetation, but also by excessive density and cover of native woody shrub species, especially in sheltered conditions such as planted groves of evergreen trees. The principal non-native invasive plants in older, stabilized San Francisco dunes are iceplant, and annual Mediterranean grasses (in particular ripgut brome). Other species which are locally aggressive and colonial invaders of stable dunes and sandy urban soils include an annual iceplant (*Conicosia pugioniformis*); Bermuda-sorrel (*Oxalis pes-capreae*); and a relatively recently established South African grass (*Ehrharta erecta*). Species like iceplant and ripgut brome tend to produce continuous, dense stands which lack vegetation gaps, and accumulate surface plant litter and soil organic matter. These conditions apparently discourage regeneration of San Francisco lessingia.

Introduced trees from plantings in former dunes such as Monterey cypress; Monterey pine; and blue gum also spread spontaneously into dune scrub over time, and may convert dune scrub remnants to non-native forests.

Small population size, small habitat patch size, and fragmentation (isolation) of habitat patches in the urban landscape are indirect effects of habitat loss and degradation, but they are now also probably independent threats to the survival of San Francisco lessingia.

The Golden Gate National Recreation Area, following the closure of the Presidio as a military facility, has led the conservation of San Francisco lessingia. The Golden Gate National Recreation Area has established site stewardship programs aimed at coordinating volunteer labor to control non-native vegetation at Presidio population sites. In cooperation with the non-profit Golden Gate National Parks Association, it has significantly expanded dune scrub habitat and population size of San Francisco lessingia at the Lobos Dune restoration area from less than 0.5 acre with a small colony to approximately 13 acres supporting an extensive, vigorous population. This restoration anticipated recovery actions in this plan, and would contribute substantially to the recovery of the species, assuming appropriate vegetation management is sustained. The Golden Gate National Recreation Area has also monitored population sizes of San Francisco lessingia over time, and fenced off remnant populations on the Presidio to protect them from excessive trampling. Joint, cooperative stewardship weeding programs run by the Golden Gate National Recreation Area and the Golden Gate National Parks Association have improved habitat quality of San Francisco lessingia sites. The Golden Gate National Recreation Area has also facilitated and permitted graduate student research on San Francisco lessingia populations, providing important basic biological information on pollination ecology and plant interactions.

Presidio Clarkia

The Presidio clarkia was federally listed as endangered in 1995 (U. S. Fish and Wildlife Service 1995). A detailed account of the taxonomy, ecology, and biology of this listed plant is presented in the *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area* (U. S. Fish and Wildlife Service 1998) and the *Draft Recovery Plan for Coastal Plants of the Northern San Francisco Peninsula* (U.S. Fish and Wildlife Service 2002).

The Presidio clarkia is a slender, erect, herbaceous annual of the evening-primrose family (Onagraceae), 16 inches tall with few, very small, and narrow leaves. The lavender-pink petals have a lighter basal portion and a reddish-purple basal spot. The slender capsule is 1 to 2 inches long. *Clarkia franciscana* can be distinguished from ruby chalice clarkia (*Clarkia rubicunda*), a related species that may occur in the same area, by its petals that have irregular teeth on the apical margin (the edge near the tip). *Clarkia rubicunda* has petals that are rounded at the apex (Lewis and Raven 1958*a*) and usually twice the length of *Clarkia franciscana* (Lewis and Raven 1958*a*; Lewis 1977).

The Presidio clarkia flowers from May to July (Munz and Keck 1959). At the Presidio, clarkia is visited by small halictid bees which may be pollinators of the species. However, plants can self-pollinate by shedding pollen directly on the stigma (female reproductive part) (Lewis and Raven 1958*a*). This listed species is thought to be predominantly self-pollinated in natural populations. Based on electrophoretic evidence, there is little genetic variability within populations of clarkia. However, the Presidio and Oakland Hills populations, which have been examined, are genetically different from one another (Gottlieb and Edwards 1992).

The Presidio clarkia is restricted to serpentine soils in grassland communities and coastal scrub in San Francisco and Alameda Counties (Skinner and Pavlik 1994). It is the only species of *Clarkia* restricted to serpentine soils (Lewis and Raven 1958*a*).

The species is known from only two natural populations: one in San Francisco at Inspiration Point in the Presidio (Area B), and a series of subpopulations in the Oakland Hills (Gottlieb and Edwards 1992). An artificially seeded population in the Presidio occurs near the parent plant of the Raven's manzanita (Area B) occurring on a coastal serpentine outcrop above the north end of Baker Beach. It was established there by translocation of seed in 1972 (Roof 1972), and has persisted since then. The main population on the Presidio is currently protected against development, but it remains strongly threatened by introduced conifers and eucalyptus trees, weedy herbaceous non-native plant species, trampling, and unfavorable mowing times (prior to seed maturation and dispersal).

The Presidio populations are threatened by habitat degradation, including mowing, trampling, roadside maintenance and presence of non-native species (California Department of Fish and Game 1996). The Presidio represents a significant natural and cultural resource within San Francisco city limits and was expected to be widely promoted and heavily used by visitors after transfer to the National Park Service (T. Thomas, pers. comm., 1992, as cited in the Serpentine Plan). Increasingly heavy use by visitors could increase negative effects on the clarkia (U.S. Fish and Wildlife Service, in litt., 1995*a*). Road maintenance and mowing of grasslands before the clarkia has set seed also threatens the Presidio populations (California Department of Fish and Game 1992) as does the encroachment of non-native plant species, including German ivy,, iceplant, and blackberries (California Native Plant Society 1988; Service, in litt., 1995*a*), non-native grasses (S. Farrell, in litt., 1996), and natives planted outside their natural range, such as Monterey pine (California Native Plant Society 1988). Two years of sampling indicate that serpentine grasslands at the Presidio support nearly 50 percent cover of non-native grasses, particularly soft brome and Italian ryegrass (S. Farrell, in litt., 1996). Removal of Monterey pines in 1995 also allowed the clarkia to move into previously unoccupied habitat (S. Farrell, in litt., 1996).

The Presidio populations of the species have been monitored annually since 1994; permanent vegetation transects were established in 1995. The largest population at the Presidio was fenced in 1995, and invasive Monterey pines occupying serpentine soil were removed in 1995 and 1996. Following tree removal in 1995, the Presidio clarkia moved into the newly open habitat (S. Farrell, in litt., 1996). Efforts to improve habitat by removing non-natives and removing accumulated acidic soils are ongoing at the Presidio.

Marin Dwarf Flax

Dwarf flax was federally listed as threatened in 1995 (U.S. Fish and Wildlife Service 1995). A detailed account of the taxonomy, ecology, and biology of the dwarf flax is presented in the *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area* (U.S. Fish and Wildlife Service 1998).

Dwarf flax is an herbaceous annual of the flax family (Linaceae) with slender, thread-like stems, 4 to 16 inches tall. The leaves are linear. The flowers are borne in congested (crowded together) clusters; the pedicels are 0.04 to 3.2 inches long. The sepals are hairy, and the five petals are rose to whitish (Niehaus 1977). The anthers are deep pink to purple; this character helps distinguish the Marin dwarf flax from California dwarf flax (*Hesperolinon californicum*), found in the same geographic area, which has white to rose anthers as well as hairless sepals. Two other species that are found in the same region are smallflower flax (*Hesperolinon micranthum*) and slender dwarf flax (*Hesperolinon spergulinum*). They differ from Marin dwarf flax in having hairless sepals and a long, open inflorescence, with pedicels 0.08 to 1 inch long (Hickman 1993).

Flowering occurs from May to June or July (Munz and Keck 1959; Skinner and Pavlik 1994). The species is pollinated by native insects including bee flies and pollen beetles (Robison and Morey 1992). Populations range in size from one plant to thousands of plants (California Department of Fish and Game 1996). Population sizes can fluctuate greatly from year to year (D. Smith, in litt., 1998). No further data on the reproductive biology or demography of the species are available.

The species is found on serpentine soils from Marin County south to San Mateo County (Munz and Keck 1959), a range of 50 miles (U.S. Fish and Wildlife Service 1995). Marin County locations include the Tiburon Peninsula , Carson Ridge, and the Mount Burdell Open Space (California Department of Fish and Game 1996), Big Rock and Golden Gate National Recreation Area (Norris 1995). Two extant occurrences are known from the Presidio in San Francisco County. Both populations are in Area B managed by the Presidio Trust. San Mateo County contains four specific locations near Crystal Springs Reservoir, two in Edgewood County Park and one near Woodside Glens. Previously identified occurrences now extirpated include two from San Mateo County and two from San Francisco County. One additional occurrence on the Tiburon Peninsula in Marin County is possibly extirpated (California Department of Fish and Game 1996).

A variety of activities have contributed to the decline of dwarf flax. These include, but are not limited to development, recreation, trampling, and competition with native and non-native species such as barbed goatgrass (*Aegilops triuncialis*). Little is known of the species' tolerance to grazing or soil disturbance. However, it is likely that dwarf flax may benefit from some levels of grazing and soil disturbance, considering the coexistence of the dwarf flax with other species, such as harvest brodiaea (*Brodiaea elegans*) and Mariposa lily (*Calochortus spp.*), which are known to benefit from disturbance.

At the Presidio one population was fenced off in 1995, and several Monterey cypress trees adjacent to the habitat were removed in 1995 and 1996. Few natives have established in the area; cypress duff and fill material from an adjacent road may prevent *the* species from moving into the restored area. Over 20,000 individuals were identified at Inspiration Point in the Presidio.

Effects of the Proposed Action

The proposed Fire Management Plan likely will result in adverse effects to the mission blue butterfly, San Francisco garter snake, California red-legged frog, Raven's manzanita, San Francisco lessingia, Presidio clarkia, and the Marin dwarf flax. There is a likelihood the animals and plants may be affected by a number of activities including being incinerated, asphyxiated, crushed, entombed in their burrows, hit and injured or killed by vehicle strikes, poisoned by chemical agents, harassed by noise, smoke and vibration, and smoke particles coating their leaves. Temporary effects are project activities that temporarily remove one or more essential components of the habitat of a listed species, but can be restored to pre-project conditions of equal or greater habitat value. In order for the effects to be considered temporary, the affected habitat of the listed species should be totally restored within two seasons. Failure to adequate revegetate the disturbed areas with appropriate locally collected native vegetation likely would facilitate the invasion and establishment by plant and animal species that are not native to the area.

Mission Blue butterfly

Implementation of the proposed project within the habitat of the mission blue butterfly may result in the death, injury, harassment, or harm to this listed animal due to clearing of vegetation and other activities associated with suppression and mechanical treatment; incineration of eggs, larvae, and adults; or the injury or death of these life history stages due to smoke inhalation. Insects breathe via spiracles and inhalation of small particles could prevent their respiration and result in their asphyxiation. In addition, the foodplants of the larvae and/or adult nectar plants could be eliminated by burning. However, the Fire Management Plan likely will assist in the elimination of invasive exotic plants that compete with native plants utilized by all life history stages of the mission blue butterfly and thus result in significant long-term benefits to the survival and recovery of this listed animal in the wild.

Activities associated with suppression and mechanical treatment likely will adversely affect the mission blue butterfly. Habitat of varying quality for this listed animal is located within the action area. Adults and early stages could be injure or killed as a result of these activities, including those from temporary and permanent disturbances of habitat. Increased levels of smoke caused by prescribed fire could clog the spiracles and asphyxiate the mission blue butterfly.

Another potential effect of the proposed project on the listed butterfly is the elimination of their habitat due to non-native vegetation invading areas where restoration has not been implemented or is inadequate. Soil disturbance, such as that associated with project associated activities, facilitates the invasion of areas by non-native species. Increased human activity in areas introduces new non-native species. Although many of these plants do not survive or thrive in the areas to which they are introduced, some do. These plants could eventually displace or otherwise out-compete the plants which are depended upon by the mission blue butterfly.

Historically, fire played a major role in maintaining California grasslands occupied by the mission blue butterfly. It seems likely that this animal has behavioral and biological adaptations to cope with fire, and that their populations can be maintained in a landscape with occasional grassland fires. However, if hot burning slow fire moves through a grassland when eggs, larvae, or pupae are present, it likely kills them. If fire occurs during the spring flight period of the mission blue butterfly, we expect that most, if not all, adults present will avoid death by flying away from the fire. After the fire is out, and the grassland has cooled down, adults are likely to return to the burned areas in search of host plants and nectar plants. This behavior was observed in the regal silverspot butterfly (*Speyeria regalis*)(Huebschman and Bragg 2000). However, at one site in the midwestern United States, the abundance of the regal silverspot butterfly was reduced for a period of 3 to 5 years following the application of fire due to the impacts on larvae food plants and adult nectar sources (Swengel 1996). Grassland fires in the San Francisco Bay area within the range of the mission blue butterfly may leave patches of unburned habitat; it is possible that this species will use host plants and nectar plants in these unburned areas. On a longer time scale, a mosaic of fire in a large habitat area could be beneficial if it retards shrub invasion or otherwise promotes host plant growth.

In moderation, grazing may be helpful to maintain habitat (e.g., Weiss 1999) for the mission blue butterfly. Appropriately timed, low-intensity grazing may reduce the invasion of exotic species. Such benefits must be weighed against the possible trampling of the early stages of the mission blue butterfly and its host and nectar plants, and disruption of cryptogamic soil crusts allowing for invasive, non-native species to gain access to good habitat and displace food sources and host plants. Grazing by Pleistocene herbivorous mammals and then domestic livestock occurred in areas inhabited by the mission blue butterfly.

San Francisco Garter Snake

Considering the Golden Gate National Recreation Area supports a number of the known populations of the San Francisco garter snake, and fire is an important component of natural ecosystems in this region of California, the mechanical treatment and prescribed fire portions of the Fire Management Plan likely will result in long-term beneficial effects to the listed reptile. In fact, fire likely is very important for maintaining the habitats of the San Francisco garter snake. However, in the short term, heat and smoke from the fires may kill or injure individuals. Individuals of the San Francisco garter snake may be adversely affected by increased levels of sedimentation into aquatic habitats caused by runoff from burned areas. If heavy sedimentation occurs in ponds or other water bodies where the prey of the San Francisco garter snake, the California red-legged frog breeds, it is possible that California red-legged frog egg masses will suffocate from being buried under sediments, and thus reduce or eliminate the listed reptile at the site. Without adequate measures, heavy loss of sediments from the streambed may result in down-cutting of channels which could further degrade the stability of banks, and functions of the riparian ecosystem. Excess sedimentation or excess numbers of fire-associated personnel and their vehicles and equipment could damage or destroy the mammal burrows used by the aestivating or hibernating snakes.

The maintenance of fire roads and trails, and mechanical treatments may result in killing or injuring San Francisco garter snakes which may be present during grading, vegetation removal or clearing, mowing, and other related activities. Clearing of vegetation (i.e., mowing) may result in harm, harassment, or killing of individuals of this listed reptile. In addition, vehicular use of fire roads and other roads may result in mortality or injury of San Francisco garter snakes which may disperse across such roads.

Migrating males, from adjacent populations, and naïve juveniles may be exposed due to their wandering habits. San Francisco garter snakes have male:female sex ratios ranging from 1:1 in populations with low numbers to 3:1 in populations with high numbers. San Francisco garter snakes dependence on gopher and possibly ground squirrel (*Spermophilus* species) burrows for retreat habitat places them in the safest possible location during a fire, especially a cool-slow fire. Juvenile San Francisco garter snakes are know to have a mortality of greater than 90%, most likely due to naiveté and predation. Gophers, which have a higher metabolism and oxygen demand than snakes, are able to persist underground during fires.

There is no scientific information on members of the genus *Thamnophis* response to smoke exposure; however, gophers and ground squirrel have higher metabolisms than snakes and easily persist through light fires in grasslands and removal of shrub canopy.

Ground squirrel and gopher burrow densities may increase significantly as a result of the mechanical treatment and prescribed fire portions of the proposed project. Gopher burrows vacated as a result of predation by raptors are typically occupied by voles. Ground squirrel and gopher burrows will provide retreats for voles and will create the sub-surface structure sufficient for San Francisco garter snakes retreat sites and occupancy of burrows. Gopher burrows are a known escape refugia for San Francisco garter snakes and are often used as hibernacula. San Francisco garter snake populations are dependent on sufficient hibernacula, situated adjacent to foraging habitat.

California Red-legged Frog

The Golden Gate National Recreation Area supports the California red-legged frog and fire is an important component of natural ecosystems in this region of California, therefore, the mechanical treatment and prescribed fire portions of the Fire Management Plan likely will result in long-term beneficial effects to the listed amphibian. In fact, fire likely is very important for maintaining the habitats of the California red-legged frog. However, in the short term, heat and smoke from the fires may kill or injure individuals. Adults or early stages of the California red-legged frog may be adversely affected by increased levels of sedimentation into aquatic habitats caused by runoff from burned areas. If heavy sedimentation occurs in pools where California red-legged frogs breed, it is possible that California red-legged frog egg masses and tadpoles will suffocate from being buried under sediments. Without adequate measures, heavy loss of sediments from the streambed may result in down-cutting of channels which could further degrade the stability of banks, and functions of the riparian ecosystem.

The maintenance of fire roads and trails, and mechanical treatments may result in killing or injuring California red-legged frogs which may be present during grading, vegetation removal or clearing, mowing, and other related activities. Clearing of vegetation (i.e., mowing) may result in harm, harassment, or killing of California red-legged frogs. In addition, vehicular use of fire roads and other roads may result in mortality or injury of California red-legged frogs which may disperse across such roads.

California Red-legged Frog Proposed Critical Habitat

This conference opinion on the proposed critical habitat for the California red-legged frog does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR § 402.02. Instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in *Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service* (No. 03-35279) to complete the following analysis with respect to the proposed critical habitat.

There will be disturbance to the proposed critical habitat in the sense that some primary constituent elements, notably upland and dispersal habitat, and perhaps breeding habitat will be disturbed. However, these effects are anticipated to be temporary, discountable, or insignificant in nature, and the proposed Fire Management Plan is anticipated to significantly improve the quality of the proposed critical habitat for the threatened California red-legged frog.

Raven's Manzanita, San Francisco Lessingia, Presidio Clarkia, and the Marin Dwarf Flax

The potential effects of the proposed Fire Management Plan to the Raven's manzanita, San Francisco lessingia, Marin dwarf flax, and the Presidio clarkia include direct mortality from burning, mowing, and clearing, or being crushed by vehicles, project-related personnel, or associated equipment. Potential harmful or injurious effects include impairment of respiratory and photosynthesis processes due to smoke resulting from project activities. Removal of structures or trees may degrade microhabitats and other site specific conditions upon which listed plants depend. Alteration of microhabitats may include the destruction of cryptogamic crusts that help to exclude invasive non-native plants and improve water infiltration. Below ground effects include loss or degradation of soil structure, fertility, porosity, and water holding capacity. These effects typically result from the soil compaction associated with the activities included as part of the proposed Fire Management Plan. Below ground effects also include potential loss of seed banks which are vital to re-establishing broadly distributed populations. Species which are broadly distributed are less likely to suffer catastrophic population declines over their entire range and less likely to become extinct.

Fire is an important component of natural ecosystems in this region of California, and the Fire Management Plan likely will result in long-term beneficial effects to the San Francisco lessingia, Marin dwarf flax, and the Presidio clarkia, especially due to the reduction or elimination of invasive exotic plant species. However, the single known individual of Raven's manzanita makes this species highly vulnerable to the potential adverse effects of the proposed project.

Deposits of high amounts of smoke particles on the listed plants can abrade leaves, and adversely affect photosynthesis (Thompson *et al.* 1984). Particle cover on leaves can also induce an increase in leaf temperature from greater absorption of incident radiation resulting in reduced net photosynthesis and productivity (Eller 1977; Hirano *et al.* 1995). Dust abatement measures that include the wetting or dampening of exposed ground surfaces may result in adverse effects. Unseasonal moisture may trigger untimely germination of seeds when growing conditions are unfavorable. Seeds may potentially germinate followed by dessication and the eventual death of seedlings, a process that has been used as an eradication method for the invasive yellow star thistle (DeTimoso, Univ. of California at Davis, pers. comm., 2000).

As previously described in this biological opinion, the activities comprising this proposed project, suppression, mechanical treatment, and prescribed burning can facilitate the encroachment of non-native plants into native plant communities, especially if restoration of native habitat is not implemented by the National Park Service. The proposed project may contribute to this encroachment as a result of soil disturbance which may provide non-native invasive or weedy plants with a competitive advantage over the listed plants.

Project-related activities within occupied habitat fragments populations and may restrict gene flow, thereby reducing the species' ability to survive and may undermine efforts to recover these species in the wild. Fragmentation of plant habitat isolates plant populations such that cross-pollination between populations becomes prohibitive or limited. Fragmentation also limits seed dispersal resulting in a reduced chance of repopulation from extirpated species. Isolation due to fragmentation can result in distinct genetic populations and the ultimate decline of some species because of the lack of genetic variability and reduced adaptability within populations.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

From 1995 to 2020, the human population is projected to increase by 18 percent for the San Francisco Bay hydrologic region, while at the same time agricultural crop land use in the region is projected to remain around 65,000 acres (California Department of Water Resources 1998). According the California Department of Forestry, from 2000 to 2020, the human population within counties in the Bay Area region is expected to grow by 29 percent (5.3 million people to 6.8 million people), and by 60 percent from 2000 to 2040 (5.3 million people to 8.4 million people) (California Department of Forestry 1998). There will likely be many other development projects that occur during this timeframe due to increases in human population growth that will continue to imperil the San Francisco garter snake, California red-legged frog, mission blue butterfly, San Francisco lessingia, Presidio clarkia, Raven's manzanita, and the Marin dwarf flax..

Non-Federal activities continue to eliminate habitat for the California red-legged frog, San Francisco garter snake, and the mission blue butterfly in the action area. Loss and degradation of habitat affecting both animals and plants with or without Service authorization continues as a result of: urbanization; and road and utility right-of-way management that may not be funded, permitted, or constructed by a Federal agency. The listed butterfly and San Francisco garter snake also likely may be subject to unauthorized collecting for commercial and personal uses. The continued spread and increasing density of exotic plant species which eliminate habitat for the six listed animals and plants is an ongoing and significant threat. Existing habitat for the San Francisco garter snake, California red-legged frog, mission blue butterfly, San Francisco lessingia, Presidio clarkia, Raven's manzanita, and the Marin dwarf flax is fragmented and extirpation of certain remaining populations is of significant concern, due to chance fluctuation of small populations, unusual climatic events, the loss of genetic fitness commonly associated with very small populations, and other factors discussed previously. The cumulative effects of these threats pose a significant impediment to the survival and recovery of these species

The application of pesticides, herbicides, or fertilizers could degrade surface water quality in wetlands, including creeks and streams utilized by the San Francisco garter snake and the California red-legged frog. Water quality may become impaired when pesticides/fertilizers or sediment enters the waterbody from the surrounding area.

Deposition of nitrogen from air pollution presents a significant threat to California grasslands (Weiss 1999). Invasive species are often better competitors for soil nutrients than native plants (Allen *et al.* 2000a). The result of high nitrogen deposition for the mission blue butterfly is a possible accelerated invasion of weedy grass and herb species that displace native host plants and nectar sources. Weeds may either out-compete the three *Lupinus* species, or grow so densely that host plants are not easily found by adult female mission blue butterflies.

Ongoing climate change threatens the phenological relationship between the mission blue butterfly, its early life history stages, and the resources necessary for their survival. Since climate change threatens to disrupt annual weather patterns, it may result in a timing mismatch between the butterflies, their nectar sources, and larval food plants. Many butterfly species have already experienced shifts in distribution and phenology in response to global warming (Hill *et al.* 1999; Parmesan *et al.* 1999; Roy *et al.* 2001). Where populations are isolated, a changing climate may result in local extinction, with range shifts precluded by lack of habitat.

Urban development results in increased numbers of pets. Both feral and domestic cats (*Felis catus*) and dogs (*Canis domesticus*) prey on aquatic and riparian species such as the San Francisco garter snake and the California red-legged frog. People exploring creeks and other water bodies inhabited by these two species can harass, collect, and kill the animals, especially the snake. Many flood control projects replace natural streams with engineered channels and isolate them from their natural floodplains, disrupting natural hydrologic processes and degrading stream habitat. Flood channel maintenance often requires the removal of emergent aquatic and riparian vegetation, making these channels less suitable for California red-legged frogs and San Francisco garter snakes.

Non-native species that prey upon, or compete with, San Francisco garter snake and California red-legged frogs continue to be released into the environment. Releases are likely to increase with an increasing number of people living in an area. Bullfrogs, goldfish, mosquitofish, warm water game fish species, crayfish, and African clawed frogs (*Xenopus laevis*) are all expected to continue to persist in the wild and degrade the quality of habitat for these two species. The introduced animals may also act as disease vectors and impact threatened and endangered species.

The endangered San Francisco garter snake is a species highly valued in the international reptile trade (Special Agent K. McCloud pers. comm. to C.D. Nagano). For example, the Laguna Salada area and the marsh near the San Francisco International Airport are both well-known collecting sites for this imperiled animal. Low numbers, and scrutiny by residents, make poaching less lucrative at the Laguna Salada area than it has been in the past. Poaching from small or isolated populations of this listed species may result in their extirpation.

A threat to the mission blue butterfly is the illegal collection for commercial and personal purposes. Adult specimens of this species are highly valued by private collectors, and an international market exists for illegally collected specimens of them, as well as other listed and rare butterflies (Ehrlich 1984; Collins and Morris 1985; U.S. Attorney's Office 1994; Williams 1996). A convicted collector had large numbers of the mission blue butterfly in his collection (C.D. Nagano, pers. obs.; U.S. Attorney's Office 1994). Butterflies in small populations are vulnerable to harm from collection of adult butterflies (Gall 1984a, 1984b). A population may be reduced to below sustainable numbers (Allee effect) by removal of females, reducing the probability that new colonies will be founded. Collectors pose a threat because they may be unable to recognize when they are depleting butterfly colonies below the thresholds of survival or recovery (Collins and Morris 1985). The extirpation of the large copper butterfly (*Lycaena dispar*) in Great Britain was preceded by heavy bouts of collecting (Duffey 1968, 1977).

Conclusion

After reviewing the current status of the mission blue butterfly, San Francisco garter snake, California red-legged frog, Raven's manzanita, San Francisco lessingia, Presidio clarkia, and the Marin dwarf flax, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that Alternative C of the Fire Management Plan at the Muir Woods National Monument, Golden Gate National Recreation Area, and Fort Point National Historic Site in Marin, San Francisco, and San Mateo counties, California, as proposed, is not likely to jeopardize the continued existence of these seven species. The proposed project is not likely to destroy or adversely modify proposed California red-legged frog critical habitat. Critical habitat has not been designated or proposed for mission blue butterfly, San Francisco garter snake, Raven's manzanita, San Francisco lessingia, Presidio clarkia, and the Marin dwarf flax, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the

take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

Sections 7(b)(4) and 7(o)(2) of the Act, which refer to terms and conditions and exemptions on taking listed fish and wildlife species, do not apply to listed plant species. However, section 9(a)(2) of the Act prohibits removal, reduction to possession, and malicious damage or destruction of listed plant species on Federal lands and the removal, cutting, digging up, or damaging or destroying such species in knowing violation of any State law or regulation, including State criminal trespass law. Actions funded, authorized or implemented by a Federal agency that could incidentally result in the damage or destruction of such species on Federal lands are not a violation of the Act, provided the Service determines in a biological opinion that the actions are not likely to jeopardize the continued existence of the species.

The measures described below are non-discretionary, and must be implemented by the National Park Service that they become binding conditions of any contract, grant, or permit issued to a contractor or applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. The National Park Service has a continuing duty to regulate the activity covered by this incidental take statement. If the National Park Service (1) fails to adhere to the terms and conditions of the incidental take statement in this biological opinion, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

NOTE: The San Francisco garter snake is a fully protected species under California law (California Fish and Game Code § 5050), and no injury or killing of this reptile is authorized by California law.

Amount or Extent of Take

The Service anticipates incidental take of mission blue butterfly, California red-legged frog, and the San Francisco garter snake will be difficult to detect or quantify because of: the elusive nature of these species, relative size, and cryptic coloration which make the finding of a dead specimen unlikely. However, the level of take of each of these three species can be anticipated by the temporal effects to cover, foraging and breeding habitat. Conservation measures proposed by the National Park Service and described above in the BA and DEIS will substantially reduce, but do

not eliminate, the potential for incidental taking of these listed species. The Service, therefore, anticipates incidental take will result from the proposed project.

The Service expects that incidental take of the San Francisco garter snake will be difficult to detect or quantify because when this listed reptile is not foraging, sunning, mating, or conducting other surface activity, it often inhabits burrows, the animal may range over a relatively large territory, it is an extremely shy animal, and the finding of an injured or dead individual is unlikely because of their relatively small body size. Losses of this species also may be difficult to quantify due to seasonal fluctuations in their numbers. Therefore, the Service is estimating that all of the San Francisco garter snakes inhabiting 108 acres, as described in the BA and DEIS will be subject to incidental take. Upon implementation of the Reasonable and Prudent Measure, incidental take associated with the fire management plan in the form of harm and harassment of the San Francisco garter snake caused by habitat loss and project activities will become exempt from the prohibitions described under section 9 of the Act.

The Service anticipates that incidental take of the California red-legged frog will be difficult to detect because when this amphibian is not in their breeding ponds, it inhabits the burrows of ground squirrels or other rodents, or may be difficult to locate due to their cryptic appearance and behavior; the sub-adult and adult animals may be located a distance from the breeding ponds; the migrations occur on a limited period during rainy nights in the fall, winter, or spring; and the finding of an injured or dead individual is unlikely because of their relatively small body size. Losses of this species also may be difficult to quantify due to seasonal fluctuations in their numbers, random environmental events, changes in water regime at their breeding ponds, or additional environmental disturbances. Therefore, based on the BA and DEIS, the Service is estimating that all California red-legged frogs inhabiting 1,732 acres will be subject to incidental take in the form of harassment and harm; and 18 California red-legged frogs will be subject to incidental take in the form of death or injury. Upon implementation of the Reasonable and Prudent Measure, incidental take associated with the proposed project in the form of harm, harassment, capture, injury, and death of the California red-legged frog caused by habitat loss and project activities will become exempt from the prohibitions described under section 9 of the Act.

The Service anticipates that incidental take of the mission blue butterfly will be difficult to detect because when this animal is in its early life history stages it is difficult to locate due to the cryptic appearance of the eggs, larvae, and pupae, and their small size. Adults may be difficult to observe due to environmental conditions or the field experience of the observers. Losses of this species also may be difficult to quantify due to seasonal fluctuations in their numbers, random environmental events, changes in the amounts of larvae foodplants or adult nectar sources, or additional environmental disturbances. Therefore, based on the BA and DEIS, the Service is estimating that all mission blue butterflies inhabiting 5,428 acres will be subject to incidental take in the form of harassment, capture, harm, injury or death. Upon implementation of the Reasonable and Prudent Measure, incidental take associated with the proposed project in the form of harm, harassment, capture, injury, and death of the mission blue butterfly caused by habitat loss and project activities will become exempt from the prohibitions described under section 9 of the Act

Effect of the Take

The Service has determined that this level of anticipated take is not likely to result in jeopardy to the California red-legged frog, mission blue butterfly, and the San Francisco garter snake or result in destruction or adverse modification of proposed critical habitat for the California red-legged frog. Critical habitat for the mission blue butterfly and the San Francisco garter snake has not been designated or proposed, therefore none will be affected.

Reasonable and Prudent Measure

The Service believes the following reasonable and prudent measure is necessary and appropriate to minimize the effect of take on the California red-legged frog, mission blue butterfly, and the San Francisco garter snake:

> Minimize the potential for harm, harassment, injury, or mortality of the mission blue butterfly, San Francisco garter snake, and the California red-legged frog.

Terms and Conditions

To be exempt from the prohibitions of Section 9 of the Act, the National Park Service shall ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.
The following terms and conditions will implement the Reasonable and Prudent Measure described above:

1. The National Park Service shall implement the conservation measures as described in the DEIS, BA, and the *Terms and Conditions* of this biological opinion.

2. An education program for the field personnel involved with the Fire Management Plan shall be conducted prior to the initiation of field activities. The program shall consist of a brief presentation by a person(s) knowledgeable in the California red-legged frog, San Francisco garter snake, mission blue butterfly, and other appropriate listed species. The program shall include the following: a description of these species and their ecology, and habitat needs; an explanation of their legal status and their protection under the Act; and a explanation of the measures being taken to avoid or reduce effects to these species during the Fire Management Plan. The education may be conducted in an informal manner (e.g., ranger and field personnel in a field setting).

3. If a California red-legged frog(s), San Francisco garter snake(s), or early stages of the mission blue butterfly are observed in the work/burn areas, a qualified biologist or an individual trained in the biology and ecology of these listed animals and designated by the National Park Service shall capture and move the animal(s) to an appropriate aquatic or upland location outside of the work area.

Reporting Requirements

The Service must be notified within 24 hours of the finding of any injured or dead mission blue butterflies, California red-legged frog, San Francisco garter snakes, or any unanticipated damage to their habitats associated with the proposed project. Injured San Francisco garter snakes or California red-legged frogs shall be cared by a licensed veterinarian or other qualified person, such as a National Park Service ranger. Notification must include the date, time, and precise location of the specimen/incident, and any other pertinent information. The Service contact persons are Chris Nagano, Deputy Assistant Field Supervisor (Endangered Species Program) at the Sacramento Fish and Wildlife Office at 916/414-6600 and Resident Agent-in-Charge Scott Heard of the Service's Law Enforcement Division at telephone 916/414-6660. Any dead or injured specimens should be deposited with the Resident Agent-in-Charge at 2800 Cottage Way, Room W-2928, Sacramento, California 95825.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to implement recovery actions, to help implement recovery plans, to develop information, or otherwise further the purposes of the Act.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any of the conservation recommendations. We propose the following conservation recommendations:

1. The National Park Service should minimize the potential for adverse effects to the Raven's manzanita, San Francisco lessingia, Presidio clarkia, and the Marin dwarf flax from the project related activities by implementation of the conservation measures as described in the BA, DEIS, and the *Terms and Conditions* of this biological opinion.

2. The National Park Service should implement the appropriate actions described in the *Recovery Plan for the California red-legged frog (Rana aurora draytonii)*.

3. The National Park Service should continue to encourage or require the use of appropriate species of locally collected California native plants in the restoration or enhancement of native species diversity and ecosystem functions at the Golden Gate National Recreation Area.

4. The National Park Service should conduct surveys to determine if the xerces blue butterfly (*Glaucopsyche xerces*) is extant within the Presidio or the Golden Gate National Recreation Area. The Service is interested in providing guidance on the appropriate survey methods and techniques for this animal.

5. The law enforcement rangers of the National Park Service should continue their vigilance for individuals who collect the endangered mission blue butterfly, endangered Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*), other listed and rare butterflies, such as the blue copper butterfly (*Lycaena heteronea*) without authorization on National Park Service lands. Illegal collection of butterflies has been documented by the Service to have occurred at Point Reyes National Seashore and Fort Baker (Cavallo Point) at the Golden Gate National Recreation Area.

REINITIATION STATEMENT

This concludes the conference opinion for effects of Alternative C of the proposed Fire Management Plan at the Golden Gate National Recreation Area, Muir Woods National Monument, and Fort Point National Historic Site in Marin, San Francisco, and San Mateo counties, California, on the proposed critical habitat of the California red-legged frog. You may ask the Service to confirm the conference opinion as a biological opinion issued through formal consultation if this critical habitat is designated. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion on the project and no further section 7 consultation will be necessary.

This concludes formal consultation on Alternative C of the proposed Fire Management Plan at the at the Golden Gate National Recreation Area, Muir Woods National Monument, and Fort Point National Historic Site in Marin, San Francisco, and San Mateo counties, California. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

If you have any questions regarding this biological opinion on Alternative C of the proposed Fire Management Plan, please contact Chris Nagano, Deputy Assistant Field Supervisor (Endangered Species Program) at the letterhead address or telephone 916/414-6600.

cc:
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