

Muir Woods National Monument
California

National Park Service
U.S. Department of the Interior



MUIR WOODS NATIONAL MONUMENT SUSTAINABLE ACCESS PROJECT

BIOLOGICAL ASSESSMENT



November 2016

MUIR WOODS NATIONAL MONUMENT

SUSTAINABLE ACCESS PROJECT

MARIN COUNTY, CALIFORNIA

BIOLOGICAL ASSESSMENT

NOVEMBER 2016

Prepared for:

NATIONAL PARK SERVICE – U.S. DEPARTMENT OF INTERIOR

Muir Woods National Monument

1 Muir Woods Rd

Mill Valley, CA 94941

and

GOLDEN GATE NATIONAL PARKS CONSERVANCY

Building 201 Fort Mason, 3rd Floor

San Francisco, CA 94123

415.561.3038

Prepared by:

Horizon Water and Environment, LLC

180 Grand Avenue, Suite 1405

Oakland, CA 94612

510.986.5420

SUMMARY OF FINDINGS, CONCLUSIONS, AND DETERMINATIONS

This document presents a Biological Assessment (BA) for the Muir Woods Sustainable Access Project (Project or Proposed Project) located in western Marin County, California. This BA presents technical information about the Proposed Project and assesses potential effects to threatened, endangered, or proposed threatened or endangered species and their habitats in accordance with legal requirements found in section 7(a)(2) of the Endangered Species Act (ESA) (50 CFR 402; 16 U.S.C. 1536[c]). This BA presents technical information about the potential effects of the Proposed Project for consultation with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) under section 7 of the ESA.

The following ESA-listed species are considered in this BA:

- Coho Salmon (*Oncorhynchus kisutch*), Central California Coast Evolutionarily Significant Unit (ESU); endangered, critical habitat present
- Steelhead (*Oncorhynchus mykiss*), Central California Coast Distinct Population Segment (DPS); threatened, critical habitat present
- California red-legged frog (*Rana draytonii*); threatened
- Northern Spotted Owl (*Strix occidentalis caurina*); threatened
- Marbled Murrelet (*Brachyramphus marmoratus*); threatened

The National Park Service (NPS) is proposing to improve visitor access and arrival facilities at Muir Woods National Monument (MWNM), better manage visitor demand and transportation services, improve visitor experience and safety, and enhance preservation of natural and cultural resources. These facilities include parking areas, bus and/or shuttle areas, stormwater management infrastructure, restrooms, and interpretive media. The purpose of this action is to improve visitor safety and experience by providing appropriate infrastructure, promote the restoration of natural resources and processes, and preserve cultural resources.

With implementation of avoidance and minimization measures listed in Section 2.2 of this BA, construction of the Proposed Project is anticipated to have insignificant and discountable effects on ESA-listed species. Long-term effects of the Proposed Project would improve habitat conditions and be considered beneficial for the above ESA-listed salmonid species. Therefore, the Proposed Project *may affect, but is not likely to adversely affect* any of these species, designated critical habitat, or essential fish habitat.

Table of Contents

	<i>Page</i>
Summary of Findings, Conclusions, and Determinations	1
Acronyms and Abbreviations	iii
1 Introduction	1
1.1 Purpose of the Biological Assessment	1
1.2 Current Management Direction	1
1.3 Consultation History	2
2 Proposed Project and Alternatives Considered	3
2.1 Proposed Project Activities	3
Project and Channel Access	7
Construction Schedule	7
2.2 Avoidance and Minimization Measures	7
3 Project Area and Action Area Description	10
3.1 Action Area	10
3.2 Geographic Location	10
Topography	10
Climate	11
Hydrology	11
Soils	12
3.3 Biological Conditions	12
Aquatic Habitats	12
Terrestrial Habitats	13
4 Pre-field Review	15
4.1 Species Considered and Evaluated	15
4.2 Essential Fish Habitat in the Action Area	19
5 Evaluated Species Information	21
5.1 Summary of Monitoring Programs and Surveys	21
Salmonid Monitoring Program	21
Surveys for California Red-legged Frog	21
Northern Spotted Owl Monitoring Program	22
Surveys for Marbled Murrelet	22
5.2 Species Status and Biology	22
Coho Salmon (<i>Oncorhynchus kisutch</i>), Central California Coast ESU	22
Steelhead (<i>Oncorhynchus mykiss</i>), Central California Coast DPS	26
California Red-legged Frog (<i>Rana draytonii</i>)	29
Northern Spotted Owl (<i>Strix occidentalis caurina</i>)	30
Marbled Murrelet (<i>Brachyramphus marmoratus</i>)	31
6 Environmental Baseline	33
6.1 Past and Current Activities within the Action Area	33

7	Effects to Evaluated Species And Determinations	34
7.1	Salmonids	34
	Effects of Sedimentation and Erosion	34
	Effects of Vegetation Removal	36
7.2	California Red-legged Frog	37
7.3	Northern Spotted Owl	37
7.4	Marbled Murrelet.....	38
7.5	Effects on Critical Habitat and EFH.....	39
7.6	Cumulative Effects.....	39
7.7	Interrelated and Interdependent Actions and Their Effects.....	39
8	Effect Determination Summary	40
8.1	Coho salmon - Central California Coast ESU	40
8.2	Steelhead, Central California Coast DPS.....	40
8.3	California Red-legged Frog	40
8.4	Northern Spotted Owl	40
8.5	Marbled Murrelet.....	40
8.6	Critical Habitat and EFH.....	41
9	Need for Reassessment Based on Changed Conditions.....	42
10	Literature Cited.....	43
11	List of Preparers.....	50

List of Figures

Figure 1	Project Location
Figure 2	Project Area and Action Area
Figure 3	Critical Habitat and CNDDDB Occurrences of ESA-Listed Species in the Vicinity of the Action Area

List of Tables

Table 1	Best management practices, avoidance, and minimization measures for the Proposed Project
Table 2	Listed species with the potential to occur within the action area
Table 3	Coho Salmon Life History Timing in Redwood Creek
Table 4	Number of Coho redds surveyed in Redwood Creek, cohort winter year 1997-1998 to winter 2013-2014
Table 5	Steelhead Life History Timing in Redwood Creek
Table 6	Number of Steelhead redds surveyed in Redwood Creek, cohort winter year 2006-2007 to winter 2013-2014

Appendices

Appendix A	USFWS Information for Planning and Conservation Report
Appendix B	Methodology for Mapping Coho Critical Habitat within the MUWO Site Improvement Project Area

Acronyms and Abbreviations

Act	Endangered Species Act
BA	Biological Assessment
BMPs	best management practices
CDFW	California Department of Fish and Wildlife
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
cm	centimeter
CNDDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CRLF	California red-legged frog
cy	cubic yards
DPS	distinct population segment
EFH	Essential Fish Habitat
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FE	Federally Endangered
FMP	Fisheries Management Plan
FT	Federally Threatened
FR	Federal Register
GGNRA	Golden Gate National Recreation Area
IPaC	Information for Planning and Conservation
MAMU	Marbled Murrelet
MBTA	Migratory Bird Treaty Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
msl	mean sea level
MWNM	Muir Woods National Monument
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPS	National Park Service
NSO	Northern Spotted Owl
PCE	primary constituent elements
Proposed Project or Project	Muir Woods Sustainable Access Project
QSD	Qualified Stormwater Pollution Prevention Plan Developer
SFAN	San Francisco Bay Area Network
SWPPP	stormwater pollution prevention plan
USFWS	U.S. Fish and Wildlife Service

1 INTRODUCTION

The Endangered Species Act of 1973 (16 U.S.C. 153 *et seq.*), as amended (ESA or Act) in section 7(a)(1) directs federal agencies to conserve and recover listed species and use their authorities in the furtherance of the purposes of the Act by carrying out programs for the conservation of endangered and threatened species so that listing is no longer necessary (50 CFR §402). Furthermore, the Act in section 7(a)(2) also directs federal agencies to consult (referred to as section 7 consultation) with the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS) when their activities “may affect” a listed species or designated critical habitat. Additionally, National Park Service (NPS) Management Policy (2006) directs the NPS to “inventory, monitor, and manage state and locally listed species in a manner similar to its treatment of federally listed species to the greatest extent possible”.

1.1 Purpose of the Biological Assessment

This biological assessment (BA) analyzes the potential effects of the proposed *Muir Woods Sustainable Access Project* (Proposed Project or Project) in the *Muir Woods National Monument* (MWNM) on federally listed threatened, endangered, proposed animal (wildlife, invertebrates, and fish) and plant species, and critical habitats, pursuant to section 7 of the ESA. Federally listed species and critical habitat meeting the following criteria are addressed in this BA:

1. known to occur in MWNM based on confirmed sightings;
2. may occur in MWNM based on unconfirmed sightings;
3. potential habitat exists for the species in MWNM; or
4. potential effects may occur to these species.

In addition, this BA provides an assessment of the potential effects of the Proposed Project on essential fish habitat (EFH) as defined under the Magnuson-Stevens Fishery Conservation and Management Act.

1.2 Current Management Direction

Current management direction for federally listed and proposed threatened and endangered species can be found in the following documents:

- 1916 NPS Organic Act
- NPS General Authorities Act of 1978
- NPS Management Policies 2006
- Golden Gate National Recreation Area and Muir Woods National Monument, Final General Management Plan/Environmental Impact Statement (NPS 2014)
- Recovery Strategy for California Coho Salmon (CDFG 2004)
- Recovery Plan for the Evolutionarily Significant Unit of Central California Coast Coho Salmon (NOAA 2012)

- Coastal Multispecies Plan, Volume IV, Central California Coast Steelhead (NOAA 2015)
- Pacific Coast Salmon Fishery Management Plan (Pacific Fishery Management Council 2016)
- Steelhead Restoration and Management Plan for California (CDFG 1996)
- Final Recovery Plan for the Northern Spotted Owl (*Strix occidentalis caurina*) (USFWS 2008)
- Recovery Plan for the Marbled Murrelet, Washington, Oregon, and California Populations (USFWS 1997)
- Recovery Plan for the California Red-legged Frog (USFWS 2002)

1.3 Consultation History

May 13, 2013	Rock Rogers of NMFS met with representatives from the NPS to discuss the project.
May 2013	Email correspondence with Rock Rogers of NMFS for guidance on determining the extent of critical habitat for Coho.
March 2016	Email correspondence with Rock Rogers of NMFS for guidance on determining the extent of critical habitat for Coho.

2 PROPOSED PROJECT AND ALTERNATIVES CONSIDERED

This section describes the Proposed Project, outlines the Proposed Project's components, and methods of construction. Measures to avoid and minimize effects to sensitive species and habitat is also included within this section.

2.1 Proposed Project Activities

The NPS is proposing to improve visitor access and arrival facilities at MWNM to better manage visitor demand and transportation services, improve visitor experience and safety, and enhance preservation of natural and cultural resources. These facilities include parking areas, bus or shuttle areas, stormwater management infrastructure, restrooms, and interpretive media.

The Proposed Project would modify the footprints of the Entry Plaza, Main Lot, Annex Lot, Conlon Lot, and the former Nursery Area, but would maintain the same number of parking spaces for privately owned vehicles as currently exists (i.e., 232 spaces) (Figures 1 and 2). Though administrative access would be maintained in the Entry Plaza, existing parking spaces would be relocated and approximately 0.4 acre would be rehabilitated with native riparian vegetation. Parking for persons with disabilities would be relocated to the Main Lot, with approximately 11 spaces available and an access point for passenger drop-off. The Main Lot would also maintain its existing footprint and contain approximately 18 parking spaces for buses, shuttles, and commercial use vehicles. The Main Lot would likely need to be restriped to meet disability parking requirements and to accommodate two additional buses spaces.

The Annex Lot would be reconfigured and restriped to accommodate approximately 125 parking spaces for privately owned vehicles. The Annex Lot would be designed with one-way aisles and a single entry and exit at the southern end of the lot to promote efficient vehicular circulation. The Conlon Lot would be widened 6 to 8 feet to accommodate a two-way driveway and approximately 48 parking spaces for privately owned vehicles. A pedestrian trail would be developed on the perimeter of the lot near Conlon Creek. Visitors parking in the Conlon Lot would cross Muir Woods Road at the Conlon Avenue intersection by way of a delineated footpath. Existing roadside parking would be eliminated on the east side of Muir Woods Road between Conlon Avenue and the Muir Woods Road bridge, and the area would be revegetated with plants native to MWNM.

A new lot would be developed in the former Nursery Area—also referred to as the Nursery Lot—and contain parking spaces for up to 48 privately owned vehicles. The structures in the former Nursery Area would be removed, and the area would require less than 0.3 acre of development. Because MWNM aims to work within the existing footprint of the former Nursery Area, minimal filling and grading would be necessary to construct the Nursery Lot. One culvert would be installed during construction to accommodate an existing drainage on site. Impervious asphalt would be used to surface the Nursery Lot, and the lot would be designed to promote one-way traffic with one entrance, one exit, and a single driveway.

Construction activities for the parking areas would involve dumping rock and other material, grading parking area base to match proposed grades, spreading aggregate base across the surface, and using a paving and roller machines to install asphalt to the surface. Work at the

Figure 1. Project Location

Muir Woods National Monument

Golden Gate National Recreation Area, California

National Park Service
U.S. Department of the Interior

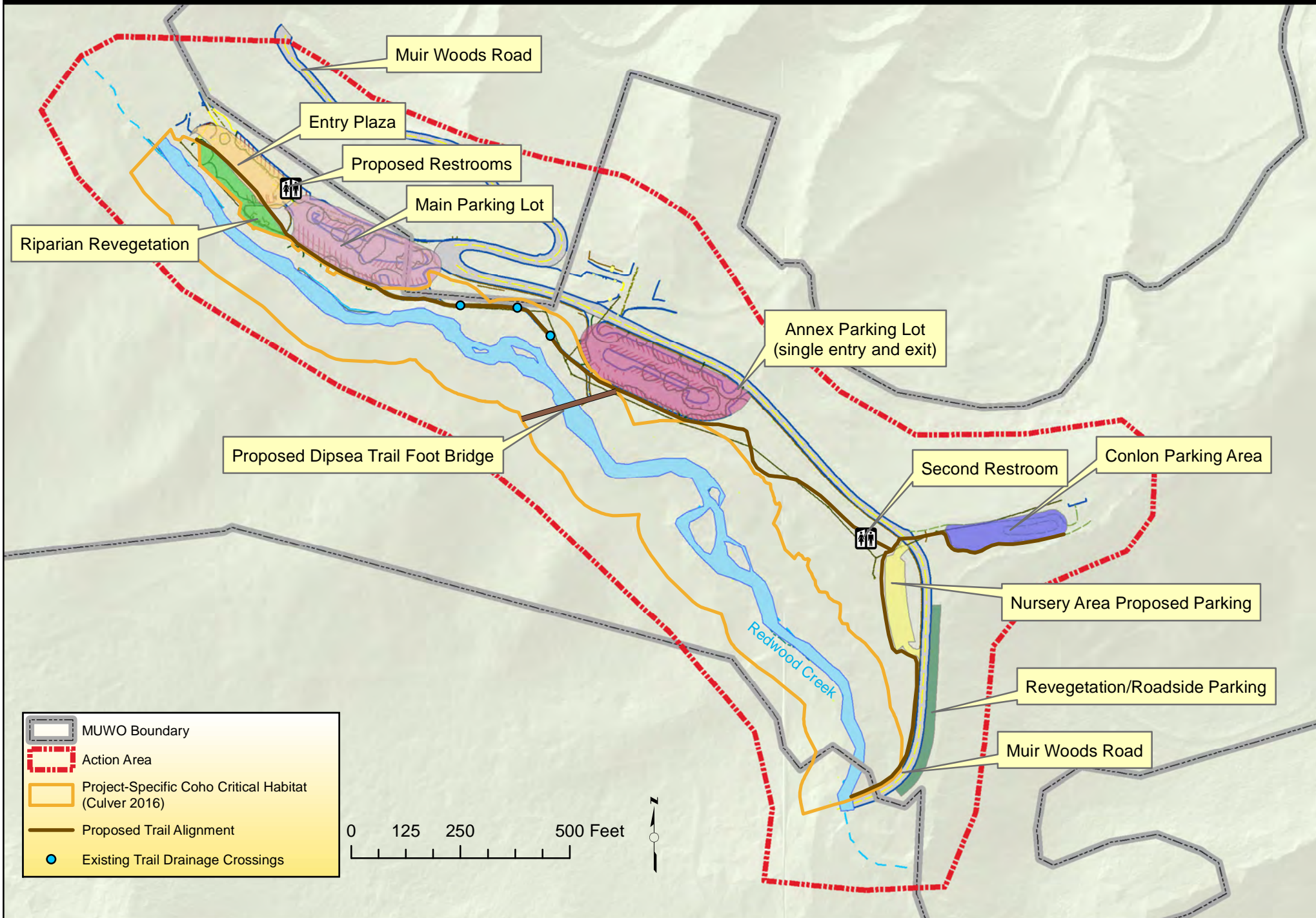


Figure 2. Project Area and Action Area

Muir Woods National Monument

Golden Gate National Recreation Area, California

National Park Service
U.S. Department of the Interior



Nursery Lot would also include clearing and grubbing of vegetation including some trees. Other construction equipment would include front-end loaders, excavators, skid steers, and bulldozers. Construction staging and material storage would be located on the existing parking areas within MWNM and at the Nursery Lot following preparation of the staging and lay down area. Sand, rock, and gravel and paving materials would be obtained from NPS-approved commercial sources near MWNM.

Engineered stormwater management facilities would be used to treat the runoff from the Entry Plaza and all parking lots. Shallow excavated ditches lined with filter strip sand and topped with stone to form a subsurface basin (where water is stored until it infiltrates into the soil) would be used to treat stormwater. This system is commonly known as an infiltration trench. The infiltration trenches would be designed and sized in accordance with Environmental Protection Agency (EPA) guidance (EPA 1999). The largest infiltration trenches would be associated with the Main and Annex Lots. These trenches would be approximately 0.04 acre. The Entry Plaza, Conlon Lot, and Nursery Lot would have infiltration trenches covering approximately 0.012 to 0.016 acre. The infiltration trenches would be installed near the parking lots.

The trail between the Main and Annex Lots would be improved and widened to 10 to 12 feet. Improvements to the trail would include minor realignments and grading to improve accessibility and replacement of deficient culverts at three locations with larger culverts or footbridges to correct drainage problems. The trail would be designed to incorporate drainage and erosion-control measures, including stabilizing the downstream drainage channel to stop further downcutting and bank sloughing near the two crossings. The drainages at the trail crossings would receive additional riprap to armor the channel and possibly larger rocks or logs for grade control. The disturbed soil areas along the trail and drainage crossings would be planted with native plant material to help minimize soil erosion. If heavy equipment access is needed for the trail work, the contractor would access the site using the existing trail prism. The Proposed Project would remove the restroom near Redwood Creek in the Entry Plaza. The restroom would remain in the Entry Plaza but be relocated outside of the erosion hazard area and would be sized to accommodate peak season visitation levels, as approved in the Muir Woods National Monument Reservation System Environmental Assessment (NPS 2015a). The relocated restroom would not impede access to the Entry Plaza. A second restroom would be constructed near the former Nursery Area to accommodate visitors parking at the southern end of the project area and would also be sized to meet peak season visitation levels. This restroom would be clearly visible from the Conlon Lot.

The segment of existing pedestrian trail along Muir Woods Road between the Main and Nursery Lots would be decommissioned and revegetated with plants native to MNWM. The Proposed Project would develop a new woodland pedestrian trail between the Annex Lot and Nursery Lot. Approximately 1,200 linear feet of disturbance would be required to construct the trail at a width of 6 to 8 feet. The trail would pass along the Redwood Creek side of the Annex and Nursery Lots, and would tie into the Dipsea Trail. Portions of the trail within or adjacent to the Annex and Nursery Lots would be developed within the existing footprint of the lots. If this alignment is not feasible, the trail would follow the perimeter of the two lots, which may require building the trail on fill. The segment of trail connecting the Annex and Nursery Lots would be approximately 570 feet and pass through Arroyo Willow Riparian Forest, Buckeye-Bay Laurel Forest and Coast Live Oak Woodland. A total of approximately 0.1 acres of vegetation would be disturbed. To

minimize disturbance, retaining walls may be constructed with handrails. Small footbridges or boardwalks would be built over any intermittent drainages along the trail route and the trail would be no steeper than a 2% running slope. New interpretive media would be located along this new trail.

The portion of the Dipsea Trail passing through the Annex Lot would be realigned to the northwest perimeter of the lot, and a new pedestrian footbridge would be installed at the Redwood Creek crossing. The pedestrian footbridge would likely be installed in the location of the existing wooden plank and placed roughly 14 feet above the creekbed so that the north side of the bridge would be at the same grade as the Annex Lot. Figure 2 shows the changes that would occur under the Proposed Project. No trees would need to be removed and the existing Dipsea Trail would retain a similar alignment.

The Proposed Project would establish additional signs directing visitors to the Entry Plaza and to local trails as a means to improve wayfinding at MWNM. The Entry Plaza would be furnished with new interpretive media telling the story of natural, historic, and cultural resource stewardship at MWNM. The segment of trail between the Main Lot and Annex Lot would also be furnished with interpretive media.

Project and Channel Access

Construction activities would require the use of trucks to haul materials from sources outside MWNM to work and staging areas in the Project area. Vehicle access to the Project area is available using Muir Woods Road via Panoramic Highway or State Highway 1. The main entrance to MWNM lies on the west side of Muir Woods Road. Parking areas associated with the Proposed Project are situated on both sides of Muir Woods Road (Figure 2).

Construction crews can access the Dipsea bridge location through the existing Annex Lot. An earthen ramp would need to be constructed on the left bank to allow for equipment access required for installation of new bridge abutments on the upper banks of Redwood Creek. Equipment would access the north (right) bank using a temporary, free spanning bridge over the wetted channel. Access to the channel would not require the removal of any existing trees.

Construction Schedule

The proposed construction schedule spans from June 2018 thru December 2020. The Proposed Project would be phased over this period to accommodate visitor parking and allow for some space to be available for construction staging. Timing restrictions to protect ESA-listed species, as described in Section 2.2 below, would be applied to construction activities during this period.

2.2 Avoidance and Minimization Measures

To help ensure the protection of biological resources the measures listed in Table 1 would be implemented to avoid and minimize potential impacts associated with the Proposed Project.

Table 1. General BMPs, avoidance, and minimization measures to be implemented during the Proposed Project for protection of biological resources.

Measure Number	Measure Description
GENERAL	
GEN-1	All resource protection measures would be clearly stated in the construction specifications, and workers would be instructed to avoid conducting activities outside the Project area.
GEN-2	A preconstruction training would be held to inform contractors about sensitive areas, including natural and cultural resources.
GEN-3	The Project limits would be delineated with temporary fencing. All surface disturbance would be confined to the delineated construction zone. All temporary fencing shall be completely removed from the Project area and properly disposed of upon completion of Project activities.
GEN-4	Staging and storage areas for construction vehicles, equipment, materials, and soils would be sited in previously disturbed or paved areas approved by NPS. These areas would be outside of high visitor use areas and would be clearly identified in advance of construction.
GEN-5	Contractors would be required to properly maintain construction equipment to minimize noise, and construction vehicle engines would not be allowed to idle for extended periods.
GEN-6	All tools, equipment, barricades, signs, and surplus materials would be removed from the Project area upon completion of the Project.
GEOLOGY AND SOILS	
GEO-1	Disturbance to soils would be avoided as much as possible and contained to as small a footprint as possible.
GEO-2	Topsoil heavily infested with invasive, nonnative plants would be removed. Non-infested topsoil would be salvaged, stored according to soil conservation guidelines, and replaced once construction is complete.
GEO-3	Erosion control measures that provide for soil stability and prevent movement of soils during rain events, such as silt fences, would be implemented.
GEO-4	Any ground surface temporarily disturbed during construction would be aerated and replanted with native vegetation to reduce compaction and prevent erosion.
GEO-5	The contractor would control dust within the construction limits, including active haul roads and staging areas. Water would be applied at the locations, rates, and frequencies ordered by the contracting officer.
VEGETATION	
VEG-1	MWNM would develop a detailed revegetation and rehabilitation plan for enhancing areas disturbed by the Project. The primary objective of the plan would be to reestablish a self-sustaining native plant community and ensure soil stability. Disturbed area treatments would include grading to natural contours; replacing stockpiled topsoil; and mulching, replanting, or reseeding with native vegetation. Planted areas would be monitored annually after construction for a minimum of five years to determine whether revegetation efforts were successful and if remedial actions such as erosion control; invasive, nonnative plant species control; or replacement plantings are necessary.
VEG-2	Disturbance to particular species such as coast redwood (<i>Sequoia sempervirens</i>), California bottlebrush grass (<i>Elymus californicus</i>), leopard lily (<i>Lilium pardalinum</i>), and California buckeye (<i>Aesculus californica</i>) would be avoided to the greatest extent possible.
VEG-3	Prior to construction, NPS would survey for rare California plants in areas where they may occur in vegetated construction zones. Surveys for state and locally (California Native Plant Society [CNPS]) listed plants that may occur in the Project area would be conducted at appropriate times. If state or locally listed plants are found and cannot be avoided, seeds would be collected and propagated before revegetating disturbed areas. Revegetated areas with rare plants would be monitored for up to three years, and remedial actions would be taken to ensure that rare plants are reestablished.
VEG-4	The contractor would prevent or minimize establishment and spread of nonnative vegetation and noxious weeds by: <ul style="list-style-type: none"> – minimizing soil disturbance – pressure washing vehicles – covering haul vehicles – limiting vehicle and equipment parking to the Project area – obtaining all fill, rock, or additional topsoil from the Project area or obtaining weed-free material from approved sources outside the monument
WATER RESOURCES AND HYDROLOGIC PROCESSES	
HYD-1	Best management practices for drainage and sediment control, as identified and used by NPS, would be implemented to prevent or reduce nonpoint source pollution and minimize soil loss and sedimentation in drainage areas. These practices may include, but are not limited to, silt fencing, filter fabric, temporary sediment ponds, check dams of pea gravel-filled burlap bags or other material, and/or immediate mulching of exposed areas to minimize sedimentation and turbidity impacts as a result of construction activities. The

Measure Number	Measure Description
	placement and specific measures used would be developed in coordination with a Qualified Stormwater Pollution Prevention Plan Developer (QSD).
HYD-2	Any erosion control materials used shall not entrap animals. Jute mesh, loose, open weave textile fiber netting, burlap or non-binded materials (e.g., rice straw) shall be used for erosion control or other purposes. Tightly woven fabric such as jute should have mesh size <1 cm while loosely woven materials be > 6 cm to avoid entrapment. No plastic mono-filament matting shall be used for erosion control.
HYD-3	Erosion control measures would be left in place at the completion of construction to avoid adverse impacts on water resources, after which time MWNM would be responsible for maintenance and removal once vegetation is established.
HYD-4	Wetlands would be identified by qualified MWNM staff or certified wetland scientists and clearly marked before construction work. Construction activities would be performed with caution to prevent damage caused by equipment, erosion, siltation, or pollutant discharges.
HYD-5	To the maximum extent practicable, no construction activities will occur during rain events or within 24-hours following a rain event.
THREATENED AND ENDANGERED SPECIES	
BIO-1	Prior to any construction-related activities, a training session shall be required for all contractors, partners, and NPS staff participating in Project-related activities in the Project area. Training would be conducted by a qualified biologist to familiarize personnel about sensitive resources in the Project area. Personnel would be provided with a brief life-history and physical description of Coho Salmon, Steelhead, California red-legged frog, Northern Spotted Owl, Marbled Murrelet, and other sensitive wildlife in the area. Training would include: staff resource contact information; identification of sensitive resources; the limits of the work area; general best management practices (BMPs); and appropriate actions to take upon encountering species status species or other wildlife. All attendees shall sign an attendance sheet along with their printed name, company or agency, email address, and telephone number.
BIO-2	No construction activities would occur at night or during dawn or dusk to minimize impacts on wildlife that are most active during these times, such as the Northern Spotted Owl.
BIO-3	The contractor would be required to keep all waste and contaminants contained and remove them daily from the work site.
BIO-4	Access and/or construction below ordinary high water shall be limited to June 15 to October 31 to minimize potential adverse effects to salmonid spawning and movement. The actual work window may be a subset of that time, and will depend upon the current water year, creek conditions, and timing of salmonid migrations.
BIO-5	The following measures would be implemented to minimize potential adverse effects to Northern Spotted Owls (<i>Strix occidentalis caurina</i>) (NSO): <ul style="list-style-type: none"> • If construction commences between February 1 and July 31, NPS shall conduct pre-construction surveys for NSO in suitable nesting habitat. • If NSO nests are detected during pre-construction surveys, no work that raise noise levels above ambient background levels shall be conducted within ¼-mile of an active nest. • Within NSO habitat, disturbance to native trees greater than 10 inches in diameter at breast height (dbh) shall be avoided where feasible.
BIO-6	The following measures would be implemented to minimize potential adverse effects to Marbled Murrelet (<i>Brachyramphus marmoratus</i>) (MAMU): <ul style="list-style-type: none"> • If construction commences between March 15 and September 15, NPS shall conduct inland pre-construction surveys for within ¼ mile of potential MAMU nesting habitat. Surveys will be conducted in accordance with <i>Methods for Surveying Marbled Murrelets in Forests: A Revised Protocol for Land Management and Research</i> (Evans Mack et al. 2003). • If MAMU breeding activity is detected during pre-construction surveys, no work that raise noise levels above ambient background levels shall be conducted within ¼-mile of an active nest.
BIO-7	The following measures would be implemented to minimize potential adverse effects to California red-legged frog (<i>Rana draytonii</i>) (CRLF): <ul style="list-style-type: none"> • A reconnaissance-level survey for CRLF shall be conducted by a qualified biologist within 48 hours prior to starting work in areas that provide potentially suitable habitat. • If no CRLF are found within the work area during the survey and then the work may proceed. If CRLF are observed, NPS will re-initiate consultation with USFWS to determine appropriate avoidance and minimization measures. Any sightings and/or injuries of CRLF shall be reported to USFWS within 24 hours. • Pipes, conduits and other materials that could provide shelter for CRLF shall be stored above ground level to reduce the potential for animals to climb into the conduits and other materials.
BIO-8	Prior to Project-related activities, a qualified biologist shall conduct pre-construction surveys for dusky-footed woodrat (<i>Neotoma fuscipes</i>). Identified woodrat houses shall be avoided to the maximum extent practicable. If houses are unavoidable, NPS shall implement informal NPS protocol of dismantling of woodrat houses.

3 PROJECT AREA AND ACTION AREA DESCRIPTION

This section describes the environmental setting of the action area, including the location, climate, local hydrology, soils, and habitat communities.

3.1 Action Area

For the purposes of this BA, the “Project area” refers to the locations where work activities would occur, including all maintenance areas, staging areas, and access points. The “action area” refers to the geographic extent of environmental changes (i.e., the physical, chemical and biotic effects) that will result directly and indirectly from Project actions.

The Proposed Project would occur along the existing roads, parking lots, bus and shuttle turnarounds, passenger unloading areas, and pathways of MWNM where sounds from vehicular traffic and other human activities occur on a daily basis, year-round. An estimated 1,800-2,900 patrons visit MWNM during the off season (i.e., November through March), with approximately 3,600-4,400 visitors during the peak months (June through August) (NPS 2015a). Annual visitation reached an estimated 1,000,747 visitors in 2014. During construction, anthropogenic noise would likely increase due to construction-related activities, equipment, vehicular traffic, and work crews. Any sounds generated from construction would be temporary, lasting only as long as the construction activity generating the sounds, and would have no long-term measurable effect on visitors, employees, or natural soundscape conditions. To account for a potential increase in ambient noise level due to construction-related activities, the action area for this BA is defined as a 200-foot buffer around the Project area. The Project area and action area are shown in Figure 2.

3.2 Geographic Location

MWNM lies within the oblong-shaped Redwood Creek watershed, with a total drainage area of 8.8 square miles (NPS 2011). The headwaters of Redwood Creek originate on the southwestern slopes of Mt. Tamalpais (elevation of 2,571 feet) flowing south to form Redwood Canyon and the heart of MWNM. Downstream of MWNM, the creek opens up to Frank Valley and a relatively broad alluvial floodplain. Redwood Creek continues south through the valley before flowing into the Big Lagoon area and into the Pacific Ocean at Muir Beach. The watershed is largely undeveloped, protected forest land managed by the Marin Municipal Water District, California State Parks (Mt. Tamalpais State Park), and NPS (MWNM and the Golden Gate National Recreation Area [GGNRA] at Muir Beach) (NPS 2011). Muir Woods Road passes through the action area.

Topography

The action area is situated at an approximate elevation of 140 feet above mean sea level (msl) (USGS 2015). The northwest trending Redwood Canyon is characterized by steep, densely wooded slopes divided by a relatively narrow fluvial floodplain. Much of the roadway and parking lots in the action area are located near the toe of the eastern slope of the canyon or on the canyon floor itself. Topography in the action area generally slopes toward Redwood Creek and gradually to the south-southeast, paralleling the flow direction of Redwood Creek.

Climate

The action area has a Mediterranean climate characterized by cool, wet winters and warm, dry summers. Average temperatures range from 40°F to 70°F throughout most of the year with temperatures below freezing extremely rare (NPS 2011). Annual precipitation at MWNM averages 37.4 inches, mostly occurring October through May with November through March being the wettest period (WRCC 2016). Fog drip is estimated to provide an additional 10 to 20 inches of water to vegetation annually, or 10 to 40 percent of the annual water supply for vegetation, but exact volumes have not been measured in the Redwood Creek Watershed (Weeks 2006, Dawson and Siegwolf 2007, as cited in NPS 2011).

Hydrology

Redwood Creek is the main hydrologic feature in the action area (Marin Coastal Hydrologic Unit, Fern Creek Hydrologic Unit 2201300003). The creek's headwaters originate approximately 2.5 miles northwest of the action area on the southwestern slopes of Mt. Tamalpais and is fed by several smaller tributaries (e.g., Fern, Laguna, Spike Buck, Rattlesnake, and Bootjack creeks). Within MWNM, Redwood Creek is constrained within the steep, narrow Redwood Canyon. During the 1930's, the Civil Conservation Corps installed check dams and rock revetments along approximately 57% of the creek channel within MWNM (NPS 2014). These modifications altered natural hydrologic processes, including bank erosion, meandering, and flooding, and resulted in channel widening (NPS 2011). The check dams have since been removed but the revetments remain on portions of the creek. Although some natural processes have returned, the creek has more riffle habitat and less deep water pool habitat than would naturally occur within a similarly sloped stream, and less large woody debris (Fong 2002, as cited by NPS 2014; NPCA 2009; NPS 2011).

Redwood Creek varies from very low flows during spring and summer to high, flashy flows during the winter (Coopridier 2004; NPS 2011). Measurements taken in the late-1980s and 2003–2004 at the Redwood Creek Bridge located at the downstream end of the action area, showed summer flows of less than 1 cubic foot per second (cfs) and peak winter flows of approximately 30 to 170 cfs (NPS 2011). More recent measurements from a monitoring station on Redwood Creek approximately 1.5 miles downstream from the action area showed the daily discharge ranged from periods of no flow to a maximum of 431 cfs (USGS 2016); older records show a high flow of 2,150 cfs (Coopridier 2004). Climate change models predict changes in the increases in the intensity and frequency of precipitation events and more frequent scouring floods, which could result in increased stormwater runoff and alterations to peak stream flows (NPS 2011, 2014). Redwood Creek continues southwest until eventually draining into the Pacific Ocean at Muir Beach.

Several intermittent tributaries or ephemeral culverts discharge drainage from the adjacent slopes into Redwood Creek within the boundaries of the action area. Conlon Creek is the main tributary, draining the steep hillslopes of Camino del Canyon northwest of Muir Woods Road (Figure 1). The creek drains a total watershed area of approximately 0.3 square miles, flowing south adjacent to the Conlon Lot, continuing along the eastern edge of Muir Woods Road, then emptying into Redwood Creek, approximately 0.3 miles downstream of the entrance to MWNM (Northern Hydrology and Engineering 2015).

Soils

Most Project-related construction activities would occur on the floor of Redwood Canyon, underlain by Blucher-Cole complex soils, 2 to 5 percent (NRCS 2016). This soil complex derives from alluvium derived from various parent material. Blucher-Cole complex is comprised primarily of Blucher silt loam (40 percent) and Cole clay loam (30 percent) (NRCS 2016). This soil complex is somewhat poorly drained and prone to occasional flooding. Blucher-Cole complex soils have a moderately high susceptibility to erosion and high rate of runoff. The largest redwood and hardwood trees within MWNM occur on this soil type (McBride and Jacobs 1978).

Other commonly occurring soil types in the action area include Centissima-Barnabe complex (loam to gravelly clay loam) 30 to 50 percent slopes predominately on the western side of the canyon and Dipsea-Barnabe very gravelly loams, 50 to 70 percent slopes or Bonnydoon gravelly loam 30 to 75 percent slopes predominately on the eastern side of the canyon (NRCS 2016). Centissima-Barnabe complex is primarily derived from weathered soft sandstone and shale. This complex is the most commonly encountered soil type within MWNM and supports all of the slope redwood stands (McBride and Jacobs 1978). Centissima-Barnabe complex is moderately susceptible to runoff and erosion. The Dipsea-Barnabe soil type is derived from sandstone and shale. This unit has a coarse texture, a high susceptibility to erosion, and a low rate of runoff. Native vegetation on this soil type consists of mixed hardwoods and conifers (USDA, SCS 1985). The Bonnydoon soil type derives from fractured sandstone. This soil unit has a very rapid rate of runoff and very high susceptibility to erosion. Native vegetation on this soil type consists mainly of grasses and forbs (NRCS 2016).

3.3 Biological Conditions

Descriptions of biotic habitats in the action area are provided in this section. The descriptions are based on field surveys (NPS 2016; and Steers 2013) and existing literature (Holland 1986; Sawyer et al. 2009; NPS 2011).

Aquatic Habitats

Riverine

Riverine habitat in the action area consists of Redwood Creek. Redwood Creek is a perennial stream. As Redwood Creek enters MWNM, it is characterized by a slope of less than 2% and gravel and cobble bed sediments (NPS 2011, 2014). The creekbed itself is largely unvegetated. The margins of the channel and small in-channel bars support some herbaceous vegetation such as iris-leaved rush (*Juncus xiphioides*), lady fern (*Athyrium filix-femina*), forget-me-not (*Myosotis latifolia*), coastal hedgenettle (*Stachys chamissonis*), giant chain fern (*Woodwardia fimbriata*), umbrella sedge (*Cyperus eragrostis*), common rush (*Juncus effusus*), horsetail (*Equisetum arvense*), coltsfoot (*Petasites frigidus*), and fringed willowherb (*Epilobium ciliatum*).

Seasonal Waters

Smaller tributaries and drainages experience seasonal flows of varying degrees. In general, the location of these habitats near existing roads, parking lots, and trails result in frequent disturbance and a mix of native and non-native ruderal species. Much of these area remain largely unvegetated with some vegetation occurring along the margins. Vegetation may include

a mix of sword fern (*Polystichum munitum*), redwood sorrel (*Oxalis oregana*), sedge (*Carex* sp.), California blackberry (*Rubus ursinus*), Western bower (*Clematis ligusticifolia*), French broom (*Genista monspessulana*), tall false oat (*Trisetum canescens*), coastal burnweed (*Senecio minimus*), poison hemlock (*Conium maculatum*), forget-me-not, peppermint (*Mentha x piperita*), and crocosmia (*Crocoshia x crocosmiiflora*)

Terrestrial Habitats

Redwood – Douglas-fir Forest

Redwood – Douglas-fir Forest is the most commonly occurring habitat in the action area as well as the Redwood Creek watershed (NPS 2011). Most of the area outside of the alluvial flats of Redwood Creek support this vegetative community.

MWNM includes the most intact old-growth coast redwood forest in the Bay Area. Some redwood trees (*Sequoia sempervirens*) in MWNM may be as much as 1,000 years old. In general, Redwoods are dominant in the northern portion of the action area with California bay laurel (*Umbellularia californica*) and Douglas-fir (*Pseudotsuga menziesii* var. *menziesii*) present. Moving downstream, Redwood species density decreases and Douglas-fir becomes increasingly co-dominant or dominant. Other tree species may also be present in this community including California bay laurel, coast live oak (*Quercus agrifolia*), big leaf maple (*Acer macrophyllum*), tan oak (*Notholithocarpus densiflorus* var. *densiflorus*), Pacific madrone (*Arbutus menziesii*), and near Redwood Creek, red alder (*Alnus rubra*).

Commonly occurring understory vegetation includes California hazel (*Corylus cornuta*), California spikenard (*Aralia californica*), redwood sorrel, sword fern, lady fern, and California blackberry.

Riparian Forest

The alluvial flats adjacent to Redwood Creek support riparian forest comprised primarily of red alder. Arroyo willow (*Salix lasiolepis*) may also be present or even co-dominant in areas. Other tree species that occur more infrequently in this vegetative community include California bay laurel, big leaf maple, California buckeye (*Aesculus californica*), and coast live oak.

Common understory plants include California hazel, creekside dogwood (*Cornus sericea* ssp. *sericea*), California blackberry, and traveler's joy (*Clematis vitalba*). Common understory herbs included sword fern, cow parsnip (*Heracleum maximum*), and stinging nettle (*Urtica dioica*), and non-native forget-me-not (*Myosotis discolor*) and veldt grass (*Ehrharta erecta*).

Mixed Hardwood Forest

Mixed hardwood forest can be found in the south and southeast portion of the action area, specifically near the Conlon Lot and Nursery Lot (Figure 2). This variable community is predominately comprised of California bay laurel and coast live oak. Along the mesic (moist) boundary of this community (e.g., near the Entry Plaza) is the Redwood/Douglas-fir community, while along the xeric (dry) boundary (e.g., on the hillslopes above Conlon Lot) are coastal scrub and grassland communities (Sawyer et al. 2009).

Understory vegetation can be highly variable as well depending on the location in the action area, the topography, the microclimatic conditions, the canopy cover, and the level of past and current level of disturbance. Common understory species may include coyote brush (*Baccharis pilularis*), California blackberry, poison oak (*Toxicodendron diversilobum*), Traveler's joy, forget-me-not, and French broom.

California Buckeye Woodland

California buckeye woodland occurs along the lower portion of the Conlon Creek drainage, adjacent to Muir Woods Road, and the Nursery Lot. California buckeye dominate this community, with some very large specimens present (trees greater than 24 inches dbh). California bay laurel, coast live oak, or red alder may be present or codominant in transition zones between other communities. Common understory plants include California blackberry, poison oak, cow parsnip, and forget-me-not.

As a species, California buckeye is widespread throughout California. However, buckeye-dominated vegetation alliances and associations are assigned a California Natural Diversity Database (CNDDB) element ranking of G3S3 and are considered rare and threatened throughout their range, with a moderate risk of extinction or elimination (CDFW 2016; Sawyer et al. 2009). No signs of California buckeye regeneration are apparent in the Project area (NPS 2013).

4 PRE-FIELD REVIEW

4.1 Species Considered and Evaluated

A list of federally listed and proposed species and designated/proposed critical habitat in the action area was obtained from USFWS' Information for Planning and Conservation (IPaC) database on October 8, 2016 (USFWS 2016a) (Appendix A). Species included on this list were evaluated for their potential to occur within the action area (shown in Table 2 below). Species with no potential of occurring in the action area are documented in Table 2 and will not be discussed further in this document. Excluded species have been dropped from further analysis by meeting one or more of the following conditions:

1. Species does not occur nor is expected in the action area during the time period activities would occur;
2. Occurs in habitats that are not present; and/or
3. Is outside of the geographical or elevational range of the species.

The potential to occur and rationale for exclusion was supported by a CNDDDB query extending from a 5-mile radius of the action area (CDFW 2016). The critical habitat and CNDDDB occurrences of ESA-listed species in the vicinity of the action area is shown in Figure 3.

Figure 3. Critical Habitat and CNDDDB Occurrences of ESA-Listed Species in the Vicinity of the Action Area

National Park Service
U.S. Department of the Interior



Muir Woods National Monument
Golden Gate National Recreation Area, California

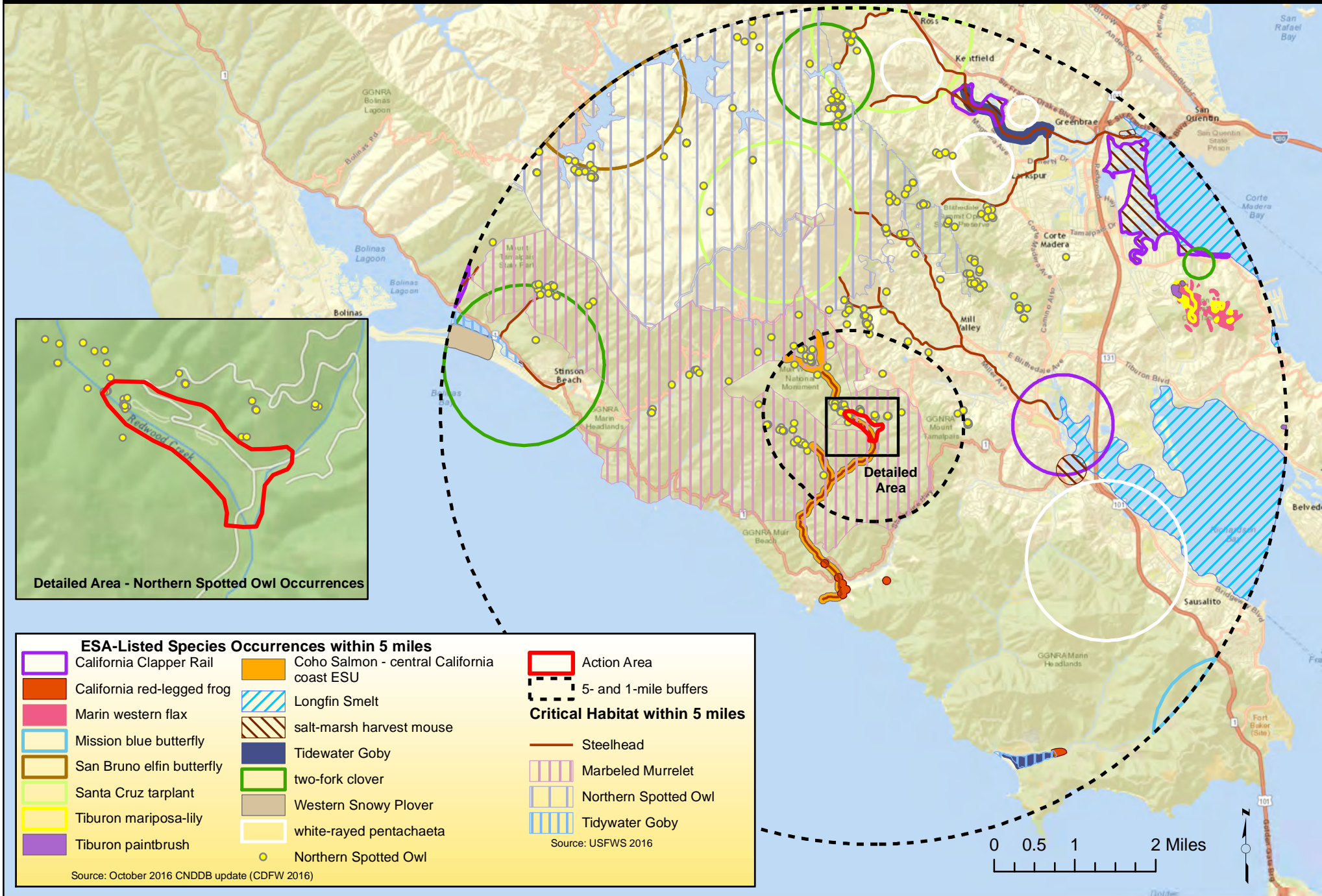


Table 2. Threatened, endangered, candidate/proposed species with the potential to occur within the action area and critical habitat. The USFWS species list (USFWS 2016a) was obtained and reviewed and species/critical habitat not having the potential to occur were excluded from further review with a no effect determination.

Species Common and Scientific Name	Federal/State listing status	Potential to Occur	Critical Habitat Present	Rationale for Exclusion	Habitat Description and Range in Action Area
PLANTS					
Marin dwarf-flax <i>Hesperolinon congestum</i>	FT; ST, 1B.1	No	No	HAB	Chaparral, valley and foothill grassland. In serpentine barrens and in serpentine grassland and chaparral. 60-370 m.
Santa Cruz Tarplant <i>Holocarpha macradenia</i>	FT; SE, 1B.1	No	No	HAB	Coastal prairie, coastal scrub, valley and foothill grassland. Light, sandy soil or sandy clay; often with nonnatives. 10-220 m.
Showy Indian clover <i>Trifolium amoenum</i>	FE; None, 1B.1	No	No	HAB	Valley and foothill grassland, coastal bluff scrub. Sometimes on serpentine soil, open sunny sites, swales. Most recently cited on roadside and eroding cliff face. 5-310 m.
White-rayed pentachaeta <i>Pentachaeta bellidiflora</i>	FE; SE, 1B.1	No	No	HAB	Valley and foothill grassland, cismontane woodland. Open dry rocky slopes and grassy areas, often on soils derived from serpentine bedrock. 35-610 m.
INVERTEBRATES					
Mission blue butterfly <i>Icaricia icarioides missionensis</i>	FE; None	No	No	ODR	Require a host plant (<i>Lupinus albifrons</i> , <i>L. formosus</i> , and <i>L. variicolor</i>) and appropriate nectar plants (various composites [<i>Asteraceae</i> sp.] that grow in association with the lupines) in a coastal grassland habitat. Found in only a few locations around the San Francisco Bay area in California: the Marin Headlands, the Skyline ridges, San Bruno Mountain, and possibly at Twin Peaks.
Myrtle's silverspot butterfly <i>Speyeria zerene myrtleae</i>	FE; None	No	No	ODR	Found in coastal dunes, coastal prairies, and coastal scrub that are protected from winds. Require host plant, <i>Viola adunca</i> . Inhabits four areas in western Marin and southwestern Sonoma Counties: 1) the coastal dunes at the Point Reyes National Seashore; 2) two populations within state beaches in Sonoma County; and 3) a single female found about 8 miles inland from Bodega Bay.
San Bruno elfin butterfly <i>Callophrys mossii bayensis</i>	FE; None	No	No	ODR	Colonies are located on steep, north-facing slopes within the fog belt. Larval host plant is <i>Sedum spathulifolium</i> . Coastal, mountainous areas with grassy ground cover, mainly in the vicinity of San Bruno Mountain, San Mateo County.
FISH					
Coho salmon - Central California Coast ESU <i>Oncorhynchus kisutch</i>	FE; SE	Yes	Yes	Included	Require beds of loose, silt-free, coarse gravel for spawning. Also need cover, cool water, and sufficient dissolved oxygen. Federal listing includes population segment between Punta Gorda and San Lorenzo River. State listing includes population segment south of Punta Gorda.
Delta Smelt <i>Hypomesus transpacificus</i>	FT; SE	No	No	HAB	Seldom found at salinities > 10 ppt. Most often at salinities < 2ppt. Sacramento-San Joaquin Delta. Seasonally in Suisun Bay, Carquinez Strait and San Pablo Bay.

Species Common and Scientific Name	Federal/State listing status	Potential to Occur	Critical Habitat Present	Rationale for Exclusion	Habitat Description and Range in Action Area
Longfin smelt <i>Spirinchus thaleichthys</i>	FC; ST	No	No	HAB	Prefer salinities of 15-30 ppt, but can be found in completely freshwater to almost pure seawater. Spawns in freshwater and rears in brackish water. Sacramento-San Joaquin Delta, Suisun Marsh, San Francisco and San Pablo Bay, Humboldt Bay, and Gulf of Farallones. Found in open waters of estuaries, mostly in middle or bottom of water column.
Steelhead, Central California Coast DPS <i>Oncorhynchus mykiss</i>	FT; None	Yes	Yes	Included	Require gravel-bottomed, fast-flowing, well-oxygenated rivers and streams. Deep low-velocity pools important for wintering. From Russian River, south to Soquel Creek and to, but not including, Pajaro River. Also, San Francisco and San Pablo Bay basins.
Tidewater goby <i>Eucyclogobius newberryi</i>	FE; SSC	No	No	HAB	Found in shallow lagoons and lower stream reaches. Species require fairly still but not stagnant water and high oxygen levels. Brackish water habitats along the California coast from Agua Hedionda Lagoon, San Diego County, to the mouth of the Smith River, Del Norte County.
AMPHIBIANS AND REPTILES					
California red-legged frog <i>Rana draytonii</i>	FT; SCC	No	No	Included	Requires 11-20 weeks of permanent water for larval development. Must have access to estivation habitat. Lowlands and foothills in or near permanent sources of deep water with dense, shrubby, or emergent riparian vegetation.
BIRDS					
Bald Eagle <i>Haliaeetus leucocephalus</i>	FD; SE, FP	No	No	HAB	Requires large bodies of water, or free flowing rivers with abundant fish, and adjacent snags or other perches. Permanent resident, and uncommon winter migrant, now restricted to breeding mostly in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity Counties.
California Clapper Rail (Ridgway's Rail) <i>Rallus longirostris obsoletus</i>	FE; SE, FP	No	No	HAB	Associated with abundant growths of pickleweed, but feeds away from cover on invertebrates from mud-bottomed sloughs. Salt-water and brackish marshes traversed by tidal sloughs in the vicinity of San Francisco Bay.
California least tern <i>Sternula antillarum browni</i>	FE; SE, FP	No	No	HAB	Colonial breeder on bare or sparsely vegetated, flat substrates: sand beaches, alkali flats, landfills, or paved areas. Nests along the coast from San Francisco Bay south to northern Baja California.
Marbled Murrelet <i>Brachyramphus marmoratus</i>	FT; SE	Yes	Yes	Included	Nest on large horizontal branches high up in large trees. Coastal birds that occur mainly near saltwater. Winters at sea. However, breeds in mature or old-growth forest stands near the coastline.
Northern Spotted Owl <i>Strix occidentalis caurina</i>	FT; SCC	Yes	No	Included	Nest in a dense section of old forest, well protected from open sky by a dense tree canopy. Mature forests with dense canopies and a complex array of vegetation types, sizes and ages.
Short-tailed Albatross <i>Phoebastria albatrus</i>	FE; SCC	No	No	HAB	Primarily a seabird with limited presence along coastal shorelines. Very small breeding range only in two Pacific islands, south of Japan. Resident of the northern Pacific Ocean, including California coast.

Species Common and Scientific Name	Federal/State listing status	Potential to Occur	Critical Habitat Present	Rationale for Exclusion	Habitat Description and Range in Action Area
Western Snowy Plover <i>Charadrius alexandrinus nivosus</i>	FT; SCC	No	No	HAB	Requires sandy, gravelly or friable soils for nesting. Sandy beaches, salt pond levees, and shores of large alkali lakes.
MAMMALS					
Salt marsh harvest mouse <i>Reithrodontomys raviventris</i>	FE; SE, FP	No	No	HAB	Pickleweed is primary habitat, but may occur in other marsh vegetation types and in adjacent upland areas. Does not burrow, builds loosely organized nests. Requires higher areas for flood escape. Saline emergent wetlands of San Francisco Bay and its tributaries.

¹ **Status Codes:** FE=federally listed endangered; FT=federally listed threatened; FC=state candidate for listing; FD= federally de-listed; SE=state listed endangered; ST= state listed threatened; FP state fully protected; SSC= state species of special concern; and 1B.1= Seriously endangered in California/Rare, threatened, or endangered elsewhere

² **Exclusion Rationale Codes:** ODR=outside known distributional range of the species; HAB= no habitat present in action area; ELE= outside of elevational range of species; SEA=species not expected to occur during the season of use/impact; and OTHER=species is absent from the action area based on comprehensive surveys

As indicated above, there are five federally listed species with the potential to occur (i.e., suitable habitat is present) in the action area: Coho salmon (*Oncorhynchus kisutch*), Central California Coast Evolutionarily Significant Unit (ESU); Steelhead (*Oncorhynchus mykiss*), Central California Coast Distinct Population Segment (DPS); California red-legged frog (*Rana draytonii*), Northern Spotted Owl (*Strix occidentalis caurina*); and Marbled Murrelet (*Brachyramphus marmoratus*).¹ These species are addressed in this BA and collectively referred to hereafter as the “evaluated species.”

4.2 Essential Fish Habitat in the Action Area

EFH is the aquatic habitat (water and substrate) necessary for fish to spawn, breed, feed, or grow to maturity (50 FR Part 227) that will allow a level of production needed to support a long-term, sustainable commercial fishery and contribute to a healthy ecosystem. Components of EFH that must be adequate for spawning, rearing, and migration include: substrate composition; water quality, quantity, depth, and velocity; channel gradient and stability; food; cover and habitat complexity; space access and passage; and habitat connectivity.

The action area is within the Tomales-Drakes Bays (USGS Hydrologic Unit Code 18050005) and is classified as EFH under the MSA. The Pacific Coast Salmon Fisheries Management Plan (FMP) is applicable to Coho Salmon, Central California Coast ESU (Pacific Fisheries Management Council 2016). The Pacific Salmon FMP is designed to protect habitat for commercially important salmonid species includes all streams, estuaries, marine waters, and other water bodies occupied or historically accessible to Coho Salmon. Exceptions to EFH include waterbodies where naturally occurring barriers (e.g., waterfalls) or specifically identified

¹ Common names of birds and fish mentioned in this report are capitalized per International Ornithological Union and American Fisheries Society guidelines.

man-made barriers (e.g., dams) now prohibit access and serve as the current upstream extent of Coho Salmon access (Stadler et al. 2011). Point Conception, California marks the approximate southern extent of the Coho Salmon range and EFH. The effects of the Proposed Project on EFH are addressed in Section 8 of this BA.

5 EVALUATED SPECIES INFORMATION

This section describes surveys methodology and background information for the evaluated species. This information provides the biological basis used to evaluate the potential presence or suitable habitat in the action area and to help analyze the potential effects of the Proposed Project on the evaluated species in subsequent sections.

5.1 Summary of Monitoring Programs and Surveys

Salmonid Monitoring Program

The NPS created the San Francisco Bay Area Network (SFAN) as a means to facilitate collaboration, information sharing, and economies of scale in natural resource monitoring for eight national park units located along the central coast of California. As part of SFAN, NPS maintains an ongoing, annual monitoring program to track population trends of salmonid throughout all lifestages. Goals of the salmonid monitoring focus on abundance and distribution trends, the size and health of the fish, effects of restoration efforts, and to evaluate if the NPS is meeting their mandate for salmon habitat protection. Monitoring is conducted using a three-tier approach:

- 1) Summer juvenile surveys are conducted from July to October utilizing a two stages process: snorkel surveys counting juvenile salmonids and electrofishing to calibrate the snorkel survey count
- 2) Winter spawner surveys occur weekly between November and February, although timing may vary due to precipitation intensity and volume. Surveys record all salmonid redds (nests), live fish, and carcasses.
- 3) Spring smolt trapping captures migrant fish downstream of the MNWM. Trapping parallels seasonal outmigration of Coho smolt, which generally occurs from late March to late May. Traps are checked daily, but may be checked more frequently if Steelhead are observed in or near the trap, or when storm events are predicted (Reichmuth et al. 2010).

Survey methodology is described in detail in the Salmonid Monitoring Protocol for SFAN (Reichmuth et al. 2010).

Information collected during the annual surveys are used to determine long-term trends in distribution, abundance, and condition of juvenile Coho and Steelhead. Although the surveys and monitoring program is focused on Coho, some information on Steelhead spawning is also gathered due to the overlap in spawning periods for presences of both species. NPS releases reports detailing monitoring results on an annual basis. The monitoring program has been in effect since 1997.

Surveys for California Red-legged Frog

GGNRA has conducted literature review, review of CNDDDB database, and several field studies to determine presence/not found status of the CRLF within MWNM and GGNRA managed lands

(Ely 1993a-b, Fellers and Guscio 2004, Fong 2000, Fong 2004, Fong and Campo 2006, Fong et al. 2010, Koo et al. 2007, Wood Wood 2004, 2005a- b, 2006a-b, 2007a, as cited in GGNRA 2016). Survey methods have included night eyeshine surveys and daytime visual encounter surveys following USFWS protocols (USFWS 2005) and dipnet surveys and traps.

Northern Spotted Owl Monitoring Program

The NPS conducts annual monitoring for NSO as part of the SFAN program. The NSO monitoring program informally began in 1993. A formal inventory of the species on federal lands in Marin County was conducted by NPS in 1997 and 1998. In 1999, NPS directed regular, long-term monitoring of 46 of the 80 known NSO territories in Marin County. Goals for NSO monitoring program aim to monitor the long-term status and trends of NSO. Since the inception of the monitoring program, numerous studies have been conducted in the area to map and classify habitat associations, nest structures, prey-base, competition from Barred Owls (*Strix varia*), and other inputs to conservation. The current NSO monitoring protocol outlined in the SFAN Northern Spotted Owl Monitoring Protocol (Press et al. 2010) is a modified version of the U.S. Department of Agriculture Forest Service Pacific Northwest Research Station Protocol. NPS releases reports detailing monitoring results on an annual basis.

Surveys for Marbled Murrelet

The Point Reyes Bird Observatory and GGNRA conducted an intensive MAMU inventory and monitoring study in MWNM in 1997 through 1999. The study employed four intensive census stations set in 1997 and 1998, following the methodology guidelines set by the Pacific Seabird Group (Ralph et al. 1994). Each station was surveyed four times throughout the breeding season. Two of the surveys for each station were conducted within the last three weeks of July when MAMU activity is thought to be the highest. One survey station was visited in the mornings. All surveys were initiated at 45 minutes before local sunrise and conducted until 75 minutes after sunrise. In 1999, MAMU eggshell surveys were conducted around potential nest trees. Additionally, shore-based surveys spent looking for MAMU at sea were conducted from Muir Beach Overlook over the course of 9 days accumulating 4.7 hours. Results and discussion of the surveys are detailed in *Bird monitoring in the Muir Woods National Monument: summary of results from 1997-1999 and suggested long-term monitoring plan* (Gardali and Geupel 2000).

5.2 Species Status and Biology

Coho Salmon (*Oncorhynchus kisutch*), Central California Coast ESU

Legal Status

Coho Salmon resident to the California central coast from Punta Gorda (Humboldt County) south to Aptos Creek (Santa Cruz County) belong to the Central California Coast ESU (NOAA 2012). This ESU was upgraded from threatened to endangered in June 2005 (70 CFR 37160). Coho are also listed as endangered under the California Endangered Species Act (CESA). Effective January 2, 2006 (70 CFR 52488), critical habitat designated for this ESU covered all river reaches and estuarine areas accessible to Coho within the ESU's historic range, which includes Redwood Creek. NMFS developed a final recovery plan (NOAA 2012) to provide guidance on actions for recovery. The recovery plan further divides the Central California Coast ESU into five distinct subgroups, or diversity strata, based on geographically distinct areas with

similar environmental conditions. Coho in Redwood Creek belong to the Coastal Diversity Strata, which encompasses residents of the Russian River, Salmon Creek, Pine Gulch, Walker Creek, and Lagunitas Creek (NOAA 2012).

Species Description

Adult Coho are a large fish ranging in size from 21 to 28 inches long (55-70 cm) and 6 to 13 pounds (3-6 kg) but can weigh as much as 35 pounds (NOAA 2016; UC Davis 2016a). Adults are mostly silver in color with dark blue or greenish backs and white or gray gums. Spawning adults may darken considerably displaying reddish sides and developing black spots on the back, dorsal fin, and upper lobe of caudal fin and a hooked jaw. Juveniles often show 8 to 12 narrow parr marks widely spaced along lateral line (UC Davis 2016a).

Habitat Requirements/Ecology

Coho are an anadromous fish species, who begin their life cycle in freshwater streams and migrate to marine environments in their adult stage. Coho in Redwood Creek have a fixed, 3-year maternal brood year cycle resulting in three separate cohorts that yield little influence on one another (NOAA 2012; Reichmuth et al. 2010). Habitat characteristics required for successful Coho development include: (1) clean loose gravels free of fine sediment; needed for spawning and egg development; (2) adequate pools and natural instream cover for juveniles; (3) connected alcoves and off channel habitats for juveniles to survive winter flows; (4) clean cool water; and (5) unimpaired passage to and from the ocean (NOAA 2012). In Redwood Creek, spawning typically occurs between mid-December to February, and juveniles emerge in March and April. Juveniles remain in fresh water for approximately 15 months before migrating to the Pacific Ocean (Reichmuth et al. 2010). The life history timing for Coho in Redwood Creek is shown in Table 3.

Table 3. Coho Salmon Life History Timing in Redwood Creek

Life Stage	Month											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Adult migration and spawning												
Incubation												
Rearing												
Outmigration												

Sources: Fong 1997a, Manning et al. 1999, and Shapovalov and Taft 1954, as cited in NPS 2011

Critical Habitat in the Action Area

Final ruling on critical habitat for the Coho Salmon, California Central Coast ESU was published on May 5, 1999 (64 FR 24049). Redwood Creek is included in the Tomales-Drakes Bays

Hydrologic Unit (USGS HUC 18050005) and has been designated as critical habitat designated as critical habitat for Central California Coast Coho salmon (64 FR 24049).

Critical habitat encompasses primary constituent elements (PCE), or specific physical or biological features that are essential to the conservation of the species. NMFS biologists developed a list of PCEs that are essential and unique to the life history of Coho and their biological needs (73 FR 7816). The PCEs for Coho are listed below:

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.
2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
3. Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.
4. Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.
5. Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.
6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Using these PCEs as a guide, NPS conducted field surveys to map critical habitat for Coho in the action area. Following guidance from the NMFS, an 85-foot buffer was later added to the bankfull edge of Redwood Creek to designate critical habitat for Coho (Culver 2016). The methodology is provided in Appendix B. Parking areas and adjacent trails were excluded from critical habitat since they do not constitute PCEs. The extents of the areas mapped as critical habitat are shown in Figure 2.

Status within the Vicinity of the Action Area

All life stages (i.e., egg, fry, parr, smolt, and adult) of coho occur in Redwood Creek. Rough estimates show sharp declines in the Central California Coast ESU population dropping precipitously from 350,000 individuals during the 1940s to less than 500 by 2009 before rebounding slightly to 2,000 to 3,000 by 2011 (NOAA 2012). Factors influencing population trends include overfishing, loss of freshwater and estuarine habitat, hydropower development, poor ocean conditions, and hatchery practices (NOAA 2016). However, observed data trends suggest that climate change will increasingly threaten the viability of Coho populations and habitats in the future (Madej 2010). Within the Redwood Creek Watershed, similar constraints have been identified as potential limiting factors to Coho success: (1) lack of sufficient pool habitat to support oversummering (especially during dry years) and (2) poor overwinter survival during wet years (NPS 2011).

Redwood Creek acts as a supporting role in the recovery of the Central California Coast ESU and Coastal Diversity Strata. The creek provides 6.8 miles of accessible habitat, or about one percent of the total potential habitat (661.7 miles) for Coho within the subgroup (NOAA 2012). However, due to the largely undeveloped nature and protected status of the watershed as state and federal parklands, this basin is considered one of the most productive and restorable basins for anadromous salmonid habitat in Marin County (CDFG 2004).

Redwood Creek within the action area provides potentially suitable spawning habitat, but the lack of pools limits habitat for juvenile salmon. Coho salmon populations can be greatly affected by floods, droughts, and other unpredictable events, which can jeopardize the survival of an entire year's spawning population. In 2006, researchers counted lower numbers of juvenile Coho per pool than average in Redwood Creek. During the 2007/2008 survey, no returning adults were observed (NPCA 2011). Only remnant Coho salmon populations remain in Redwood Creek and are at or near extirpation (CDFW 2015). The downlisting and delisting spawner target abundance are 136 and 272 adults, respectively (NOAA 2012).

Population estimates of Coho salmon calculated through the SFAN salmonid monitoring program. Since redds are directly related to the number of returning reproductive adults, redd number and density can provide an effective means of estimating population size in Redwood Creek. The number of surveyed redds is presented in Table 4.

Table 4. Number of Coho redds surveyed in Redwood Creek, cohort winter year 1997-1998 to winter 2013-2014

Year	Number of Surveyed Redds
1997-1998	72
1998-1999	41
1999-2000	5
2000-2001	12
2001-2002	20

2002-2003	3
2003-2004	42
2004-2005	73
2005-2006	11
2006-2007	21
2007-2008	0
2008-2009	2
2009-2010	23
2010-2011	3
2011-2012	4
2013-2014	5

Source: SFAN Inventory and Monitoring Data, *Carlisle et al. 2016*

Steelhead (*Oncorhynchus mykiss*), Central California Coast DPS

Legal Status

Steelhead found in the Redwood Creek watershed belong to the Central California Coast DPS (NOAA 2015), which includes coastal drainages from the Russian River (Sonoma County) to Aptos Creek (Santa Cruz County) and the drainages of San Francisco and San Pablo Bays, excluding the Sacramento–San Joaquin River watershed (NOAA 2015). This DPS was originally listed as threatened under the federal ESA in 1997 (63 FR 32996) and reaffirmed threatened in 2006 (71 FR 834), but it is not currently listed under CESA.

Species Description

Adult Steelhead have a silver-colored body with black spots on the upper fins and a broad, reddish band from the gills to the tail along the lateral line. The reddish color may be more pronounced in spawning males. Juvenile Steelhead display a similar appearance but possess 5 to 13 dark dorsal spots (parr marks) along the body between the head and the dorsal fin. Steelhead are typically lighter in color than resident rainbow trout. Steelhead generally range in size from 13 to 26 inches in length and 3 to 12 pounds, although they have reached as much as 27 pounds in California (UC Davis 2016b). Steelhead have a large mouth with teeth on both the upper and lower jaw.

Habitat Requirements/Ecology

Like Coho salmon, Steelhead are an anadromous species. Habitat requirements and area is similar to and overlaps Coho salmon habitat (NPS 2005). Habitat preferences for juvenile

Steelhead= are deep pools created by rootwads and boulders in heavily shaded stream sections, although Steelhead less than one year of age are often forced into shallow water habitats. Spawning typically occurs in late winter or spring. The amount of time Steelhead rear in freshwater and marine/estuarine habitats is variable, ranging between one to three years (NPS 2014). Unlike other species of salmon, Steelhead do not necessarily die after spawning and are able to spawn more than once (USFWS 2016b).

Steelhead populations can be broadly categorized into two reproductive groups, winter-run (or “ocean maturing”) and summer-run (or “stream maturing”). Steelhead in the Central California Coast DPS, including in Redwood Creek, are winter-run (NPS 2011). Although the life history of Steelhead follows the same general pattern as Coho from hatching in freshwater, migrating to the ocean to mature, and returning to freshwater to spawn, Steelhead timing of development is far more variable. Juvenile Steelhead may reside in freshwater for 1 to 4 years prior to migrating to the ocean, then spend an additional 1 to 3 years in the ocean before returning to their natal streams to spawn (Reichmuth et al. 2010). In Redwood Creek, Steelhead generally display a much broader spawning window (December to May) and a wider juvenile emigration period (April to June) than Coho (NPS 2011). Steelhead may also spawn more than once before dying. This variability in timing prevents the development of cohort groupings. The life history timing for Redwood Creek Steelhead is shown in Table 5.

Table 5. Steelhead Life History Timing in Redwood Creek

Life Stage	Month											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Adult migration and spawning												
Adult (kelts) return to sea												
Incubation												
Rearing												
Outmigration												

Sources: Fong 1997a, Manning et al. 1999, and Shapovalov and Taft 1954, as cited in NPS 2011

Critical Habitat in the Action Area

Redwood Creek is included in the Marin Coastal Hydrologic Unit – Bolinas Subarea (Hydrologic Unit 220130) and has been designated as critical habitat for Steelhead (70 FR 52488). The PCEs for Steelhead critical habitat are the same as Coho, but the limits of critical habitat are the lateral extents of the stream as defined by the ordinary high-water line. The ordinary high-water line for Redwood Creek was mapped in the field during a wetland delineation (NPS 2016) and is shown in Figure 2.

Status within the Vicinity of the Action Area

Although information quantifying the Steelhead, Central California Coast DPS, population size remains limited, recent estimates are approximately 14,100 adults per year, compared to estimates of around 94,000 in the 1960s (Moyle et al. 2008). Subsequent reviews and data trends suggest that many of the populations in the Coastal San Francisco Bay and Interior San Francisco Bay were likely at high risk of extinction due to the loss of the majority of the historical spawning habitat behind impassible barriers, and the heavily urbanized nature of most of these watersheds downstream of barriers (NOAA 2016). Causes of decline for Steelhead trout are the same as those listed for Coho—overfishing, habitat loss and degradation, and climate change (NPCA 2011; NOAA 2015). Increased air and stream temperatures, as well as reduced precipitation and stream flows, are stressors affecting this species. These data trends suggest that climate change is an increasing threat to Steelhead trout populations (Madej 2010).

NMFS identified Redwood Creek as a supporting creek in the role of Steelhead population (NOAA 2015). Despite Redwood Creek historically providing good spawning habitat for Steelhead, alterations to the creek resulted in a loss of pools and reduced the availability of preferred habitat for this species (NPCA 2011). The delisting spawner target abundance ranges from 38 to 78 individuals (NOAA 2015).

Although the field surveys record Steelhead data, the SFAN salmonid monitoring program largely focuses on Coho numbers. Definitive population estimates for Steelhead in Redwood Creek remain unclear. Redd detection is the key factor in determining adult Steelhead abundance since redds are directly related to the number of returning reproductive adults. Based on surveys conducted for Coho since 1997, Coho and Steelhead redd densities are typically highest near the main visitor access areas of MWNM, approximately 3.1 to 3.7 miles upstream from the mouth of the creek (Carlisle et al. 2008, as cited in NPS 2011). The number of surveyed redds is presented in Table 6.

Table 6. Number of Steelhead redds surveyed in Redwood Creek, cohort winter year 2006-2007 to winter 2013-2014.

Year	Population Estimate
2006-2007	11
2007-2008	n/a
2008-2009	9
2009-2010	n/a
2010-2011	9
2011-2012	23
2013-2014	10

Sources: Ketcham et al. 2005; Carlisle et al. 2013; Carlisle and Reichmuth 2015; Carlisle et al. 2016; Reichmuth et al. 2016.

California Red-legged Frog (*Rana draytonii*)

Legal Status

California red-legged frog (CRLF) was listed as threatened throughout its range on May 23, 1996 (61 FR 25813). A recovery plan was completed in 2002 (67 FR 57830).

Species Description

CRLF is a highly aquatic ranid frog. CRLF ranges from 1.5 to 5.1 inches in length (Stebbins 1985). Adults vary in color from reddish-brown, brown, gray, or olive with small black flecks and spots on the back and sides. The rear legs show dark banding on the upper portions and red coloring underneath. The skin appears smooth with a visible (lateral) line on the sides of the back. This species has a varied diet, including mainly invertebrates. Larger CRLF may also prey on vertebrates such as Pacific tree frogs (*Hyla regilla*) and California mice (*Peromyscus californicus*) (Hayes and Tennant 1985).

Habitat Requirements/Ecology

The CRLF primarily breeds in ponds (Stebbins 1985) although individuals also breed in slow-moving, pond-like parts of streams, marshes, and lagoons (Lannoo 2005). They are typically associated with emergent vegetation, such as cattails, rushes, or willows. Water depth is generally greater than about 3 feet, although some have been known to breed in 1.5 feet of water (Lannoo 2005).

Critical Habitat in the Action Area

Critical habitat was designated in 2001 (66 FR 14626) and revised in 2010 (75 FR 12816). No critical habitat for CRLF is present in MWNM.

Status within the Vicinity of the Action Area

All life stages (i.e., egg, fry, parr, smolt, and adult) of steelhead occur in Redwood Creek. Throughout its range, habitat loss, degradation, and modification is the primary factor affecting CRLF populations (USFWS 2002). Disease and predation, especially from non-native bullfrogs (*Lithobates catesbeianus*), crayfish (*Pacifastacus* sp.), and introduced fish species also play a significant role in the overall decline of CRLF. Although CRLF and bullfrogs have been known to occur at the same sites, studies have shown that CRLF populations decline dramatically and eventually disappear once bullfrogs become established (USFWS 2002). Bullfrogs are known to inhabit the Redwood Creek watershed.

Thorough literature reviews, CNDDDB records queries, and comprehensive surveys report no known detections of CRLF in MWNM. This species is known to occur in Frank Valley near Muir Beach (CDFW 2016). Preferred habitat consists of in small, man-made ponds adjacent to Redwood Creek, approximately 1.6 miles downstream of the action area.

Northern Spotted Owl (*Strix occidentalis caurina*)

Legal Status

The Northern Spotted Owl (NSO) was listed as threatened in Washington, Oregon, and California on June 26, 1990 (55 CFR 26114). A revised recovery plan was released in 2011 (USFWS 2011).

Species Description

NSO are large owls, 18.5 to 19 inches in length, with rounded heads lacking ear tufts, broad, rounded wings, and a short tail. Adults are dark-brown with white mottling/spotting on the breast, underparts, and flanks. NSOs have brown eyes and dark-brown facial disks with pale markings that form an 'X' between the eyes (Press et al. 2010). NSO appear very similar to Barred Owl, a competitive species whose range is expanding and may displace NSO. Barred Owl can be differentiated from NSO due to their slightly larger size and vertical brown and white streaking on the belly.

Habitat Requirements/Ecology

NSO are strongly associated with mature and old-growth coniferous forests throughout their range, but may extend into a mix of old and younger forest stands, as well as oak woodlands bordering coniferous forests (Press et al. 2010). Important habitat for nesting and foraging include: a high, dense canopy; a complex understory structure; botanical diversity; a high density of potential nest locations; and large accumulations woody debris along the forest floor (Press et al. 2010). NSO in MWNM have been documented nesting in a variety of trees including coast live oak, California bay laurel, and tan oak, some of which have been relatively small diameter. This species most commonly nests in old coast redwood trees and Douglas-fir trees. The primary food source for NSO in MWNM are dusky-footed woodrats (Press et al. 2010).

Although loss of habitat because of development is a concern throughout much of its range, the USFWS has identified competition with the Barred Owl as the primary threat to NSO (USFWS 2011). Barred Owls have been shown to display aggressive behavior toward NSO, sometimes leading to displacement of individuals or nests. This has become an increasing threat to NSOs as Barred Owl range and population size have expanded in recent decades (Kelly et al. 2003). Barred Owls have been recorded in Marin County and MWNM. Beyond habitat loss, competition from Barred Owls is suspected to be the one of the main drivers in the decline of NSO populations. In 2015, the female from the Muir Woods Barred Owl pair was collected as part of a research project. The male Barred Owl, which had been previously fitted with a radio tag, was found dead shortly after that. Based on 2016 monitoring, there were no Barred Owl detection in MWNM. Other threats to NSO in the action area intense recreational pressure, disturbance from park users, genetic isolation, loss of habitat, and disease.

Critical Habitat in the Action Area

USFWS designated critical habitat in 1992 (57 FR 1796) and published a revised designation of critical habitat on August 13, 2008 (73 CFR 47326). No critical habitat for NSO is present in

MWNM. The nearest designated critical habitat is located north of Highway 1, approximately 1.3 miles north of the action area.

Status within the Vicinity of the Action Area

Marin County represent the southern limit of NSO distribution. The 1997/1998 NPS inventory study identified at least 80 pairs of NSO throughout Marin County (Press et al. 2010). Long-term monitoring of NSO in MWNM continued following the NPS inventory study, including in MWNM and the action area. Surveys conducted in 2013 identified 110 known NSO territories in Marin County (Ellis and Harrigan 2016). When monitoring began in 1999, two pairs of NSO occupied MWNM, but NSO have not established an activity center within the boundaries of MWNM since 2010 (Ellis and Harrigan 2016). A breeding pair of Barred Owls was first documented in MWNM in 2007, with Barred Owls occupying and/or breeding in MWNM through 2015. As part of a research project, radio tags tracked the movements of the Barred Owl pair dwelling in MWNM. The male Barred Owl perished in 2015 and no Barred Owl detections occurred in MWNM during the 2016 surveys. With the nesting Barred Owl pair gone from MWNM, it is likely that NSO will move back to historic nesting areas previously occupied on Redwood Creek across from the Entry Plaza and farther into MWNM. Recorded observations of NSO near MWNM are shown on Figure 3.

Marbled Murrelet (*Brachyramphus marmoratus*)

Legal Status

The Marbled Murrelet (MAMU) was federally listed as threatened in Washington, Oregon, and California on October 1, 1992 (57 FR 45328), and listed as endangered in California. The MAMU recovery plan was released in 1997 (USFWS 1997).

Species Description

MAMU is a small, plump seabird with a very short neck, a short pointed beak, and a short pointed tail. Breeding adults display mottled dark brown to blackish upperparts, a white belly, and a mottled throat (USFWS 2016c). During the winter, the upperparts become grey, dark marks form on the sides of the breast and a white ring develops around the eye. Males and females are similar in appearance and size. Juveniles are similar to non-breeding, wintering adults, but with lightly speckled underparts.

Habitat Requirements/Ecology

MAMU spend the majority of their lives on the ocean, but nest in old-growth forests. MAMU nest sites have been documented up to 50 miles inland (USFWS 1997). In California, nests are typically found in coastal redwood and Douglas-fir forests. In general, MAMU nest on platforms of large limbs or deformities in large conifers. MAMU do not build nest structures but lay one egg in small depressions of moss or similar debris. Nesting may occur from late March to late September (USFWS 1997). MAMU diet consists primarily of fish and invertebrates in nearshore marine waters.

Critical Habitat in the Action Area

The final designation of critical habitat was published May 24, 1996 (61 FR 26257) and revised October 5, 2011 (76 FR 61599). Portions of Mt. Tamalpais State Park and County-owned land directly adjacent MWNM are designated critical habitat for MAMU. However, the designated critical habitat for MAMU does not include MWNM.

Status within the Vicinity of the Action Area

MAMU may winter off much of northern California coastline south to Monterey Bay, but may also occur in small numbers farther south to Point Conception (USFWS 1997). Systematic surveys for MAMU, including intensive censuses, eggshell surveys, and shore-based surveys, were conducted from 1995 through 1998 in MWNM with no confirmed observations reported (Gardali and Geupel 2000). At least two studies assessing offshore distribution and abundance reported no MAMU in waters adjacent to Muir Woods during the breeding season (Briggs et al. 1987, Ralph and Miller 1995, as cited in Gardali and Geupel 2000), nor have surveys detected this species in the nearshore waters off of Muir Beach (Gardali and Geupel 2000). The absence of MAMU in the watershed may be explained by the fact that relatively few trees in the area appear suitable for nesting (Hamer and Nelson 1995; Gardali and Geupel 2000; T. Gardali, pers. obs., as cited in NPS 2011).

6 ENVIRONMENTAL BASELINE

As defined under the ESA, the environmental baseline includes past and present impacts of all federal, state, and private actions in the action area; the anticipated impacts of all proposed federal actions in the action area that have undergone formal or early section 7 consultation; and the impact of state and private actions which are contemporaneous with the section 7 consultation process. Future actions and their potential effects are not included in the environmental baseline. This section in combination with the previous section defines the current status of the species and its habitat in the action area and provides a platform to assess the effects of the proposed action under consultation with the USFWS.

6.1 Past and Current Activities within the Action Area

MWNM has been a popular destination for visitors for decades, with as many as 750,000 to 1 million annual visitors dating back to the 1960s. MWNM receives very heavy visitation during the peak season (April through September) and in the off season on holidays and during periods of good weather. Visitors traveling to MWNM use Muir Woods Road, a winding two-lane county road that often results in large vehicle backups. The transportation system dates to the 1960s when standards for environmental protection differed from current standards. Parking at MWNM often exceeds capacity during the peak season and informal overflow parking occurs on the shoulders of Muir Woods Road, disturbing plant growth and increasing the susceptibility to erosion. Currently, visitors experience potentially unsafe conditions at MWNM because of the lack of pedestrian walkways in areas frequented by tour buses, shuttles, and privately owned vehicles. Approximately 1,100,000 people visited MWNM in 2015. The high number of daily visitors causes ambient noise to rise to a moderate to high relative sound level (USFWS 2006).

In addition, the existing stormwater management system is inadequate or ineffective in some areas and does not comply with current federal law, policy, and regulation. The aging infrastructure leads to increased peak stormwater flows to Redwood Creek, which can carry large volumes of suspended sediment or other pollutants transported from roadways, parking lots, pedestrian trails, or areas of disturbance. This aging and stressed infrastructure lowers the water quality in the Redwood Creek and associated drainages.

In response to heavy visitation, the NPS has taken steps to manage visitation levels by expanding the Muir Woods Shuttle service to promote public transportation, installing and operating changeable message signs on US Route 101 to inform visitors that parking may be unavailable, more actively managing parking areas, and increasing interagency enforcement actions to reduce illegal parking. NPS is in the process of implementing a reservation system to manage motorized vehicle access to MWNM and reduce visitation and transport levels to approximately 924,400 visitors in 2017.

7 EFFECTS TO EVALUATED SPECIES AND DETERMINATIONS

This section evaluates potential direct and indirect effects to listed species and habitats. Since the habitat requirements and ecology of Coho and Steelhead overlap in Redwood Creek, potential effects to these species are covered together under 'salmonids,' with key differences to individual species specifically identified.

7.1 Salmonids

Construction of the Proposed Project would not require in-water work, dewatering, or pile driving. This greatly minimizes the potential for adverse effects to salmonids. However, the Project would require ground disturbance and vegetation removal in close proximity to Redwood Creek. These activities could result in erosion, sedimentation, vegetation removal and subsequent habitat alterations. The potential effects of these disturbance mechanisms on salmonids are discussed below.

Effects of Sedimentation and Erosion

Construction-related increases in sedimentation and siltation above background levels could potentially affect salmonids and their habitat. Excessive sedimentation can adversely affect salmonids by reducing egg and juvenile survival; interfering with feeding activities; causing a breakdown of social organization; irritating sensitive tissues, such as gill and eye membranes; and reducing primary and secondary productivity, which could alter the food web on which fish rely. The magnitude of potential effects on fish depends on the timing and extent of sediment loading and flow in the creek before, during, and immediately following construction.

The primary Project activities that could result in erosion and sedimentation within Redwood Creek are construction of the Dipsea Trail Bridge and replacement of existing culverts on small tributary drainages. To a lesser extent, parking area reconfiguration, trail construction, and installation of a new culvert at the Nursery Lot could also result in erosion and sedimentation adjacent to the creek.

The construction of the Dipsea Trail Bridge would have the largest construction footprint within the stream corridor. As described in Section 2.1, the existing Dipsea Trail crossing would be replaced with a free-spanning pedestrian bridge located outside the 100-year flood zone. The Dipsea Trail Bridge would span a riffle/run section of Redwood Creek west of the Annex Lot (Figure 2). Construction of the bridge would require the use of heavy equipment to excavate and install bridge abutments on both banks. Although the abutments themselves would be outside of the 100-year flood zone, a temporary crossing would be laid across the channel to allow for construction access to the right (south) bank. Instream habitat at this location consists mostly of larger cobbles and boulders and lacks bank cover, refuge, pools, or backwater areas. These characteristics physically limit the available habitat for juvenile salmonid rearing. As such, salmonids would be expected to occur in this portion of the creek during migration periods, but are not expected to occupy the area during the dry season.

Replacing existing culverts would require clearing and grubbing of streamside vegetation and placement of new culverts, large rock, and stream substrate to provide energy dissipation. The

culverts are located on intermittent drainages adjacent to Redwood Creek in areas that are not accessible to salmonids in the dry season.

Avoidance and minimization measures would be implemented to reduce the potential for adverse effects on salmonids during construction. Measure BIO-4 would limit access below the Redwood Creek channel below ordinary high water to June 15 to October 31 to avoid salmonid migration periods. The actual work window may be a subset of that time, and will depend upon the current water year, creek conditions, and timing of salmonid migrations. In addition to Measure BIO-4, several measures would be implemented to reduce the potential for Project activities to result in erosion and sedimentation, including:

- GEN-1, limiting the area of disturbance; installation of temporary fencing;
- GEN-4, locating staging and storage areas to existing developed or disturbed areas;
- GEN-5, requiring equipment to be properly maintained;
- GEO-1, limiting soil disturbance;
- GEO-3, implementing erosion control measures prior to rain events;
- GEO-4, requiring aeration of disturbed soils prior to replanting;
- GEO-5, implementing dust control measures;
- VEG-1, revegetating and enhancing disturbed areas;
- HYD-1, implementing BMPs for drainage and sediment control;
- HYD-3, managing erosion control measures until vegetation has reestablished;
- HYD-4, avoiding wetland areas (outside the construction footprint);
- HYD-5, restricting construction activities during rain events; and
- BIO-3, restricting waste and contaminants from entering waterways.

With implementation of these avoidance and minimization measures potential adverse effects to salmonids resulting from sedimentation and erosion would be insignificant.

Over the long-term (i.e., more than 1 year following construction), the Project is expected to reduce the potential for erosion and sedimentation in this portion of Redwood Creek. Presently, visitors using the Dipsea Trail cross the creek via two wood planks elevated just above the surface of the water. Visitors often circumvent the planks and cross directly through the creek stirring up the streambed. In addition, pedestrian traffic has trampled vegetation leaving the banks compacted and barren of vegetation, in turn, increasing erosion and sediment load. During the wet season, elevated flows force the removal of the planks, rendering the creek impassable or forcing visitors to cross directly through the water. Furthermore, the culvert replacements would stabilize erosion on tributaries that enter the creek. Disturbed and eroded banks at the bridge site and at culvert outfalls would be regraded, restored, and revegetated, thereby reducing sedimentation within the creek.

The Proposed Project is specifically designed to address areas of erosion and incorporate treatment facilities to improve stormwater runoff, thereby improving the physical conditions and water quality of Redwood Creek and salmonid habitat. Project components that would reduce

the volume of sediment and pollutants reaching Redwood Creek and beneficially impact water quality include:

- Using impervious asphalt for trail improvements and reducing trail related sediment sources. Reconfiguration and development of new trails would occur within the footprint of existing trails and parking areas, excluding the addition of a new woodland pedestrian trail between the Annex Lot and Nursery Lot. This trail would avoid drainages using free-span bridges and effect to stormwater runoff and water quality would be nominal.
- Construction of dedicated stormwater infiltration system addressing the Entry Plaza, Main Lot, Annex Lot, Conlon Lot, and Nursery Lot. These engineered stormwater systems are specifically designed to capture stormwater flows from parking lot and hardscaped areas in excavated trenches lined with filter strip sand and topped with stone to form a subsurface basin, where water is stored until it infiltrates into the soil. Currently, stormwater runoff from parking areas enters drainages and the creek largely untreated. The stormwater treatment facilities associated with the Proposed Project would help limit nonpoint source pollutants and suspended sediment from reaching Redwood Creek.
- Elimination and revegetation of roadside parking on the east side of Muir Woods Road between the Conlon Lot and the Muir Woods Road bridge. Under current conditions, continued vehicular incursion of vegetated and barren areas along Muir Woods Road increases disturbance and the susceptibility of areas to contribute to surface runoff and sedimentation load.

These actions would lower sedimentation rates and improve water quality of stormwater runoff. This would result in beneficial effects for salmonids and aquatic habitat conditions in Redwood Creek.

Effects of Vegetation Removal

Instream and streamside vegetation serve important roles in aquatic ecosystems. Riparian vegetation can provide a shade canopy that buffers water temperature, decreases erosion, and/or provides cover from predators (Murphy and Meehan 1991, McCormick and Harrison 2011, Wootton 2012). Streambank vegetation might also provide allochthonous (i.e., derived from outside the system) nutrient inputs, such as terrestrial invertebrates and leaf litter, which provide food for fish either directly or indirectly by increasing production of detritivorous (i.e., eating dead organic matter) aquatic invertebrate prey (Allan et al. 2003, Kawaguchi et al. 2003, Baxter et al. 2005). Loss of riparian vegetation could result in reduced instream habitat availability, increased predation, and reduced prey availability (DeVore et al. 1980, Birtwell et al. 1984, Fischer et al. 2010).

The primary Project activities that would require the removal of vegetation within Redwood Creek corridor are the Dipsea Trail Bridge construction and replacement of existing culverts on small tributary drainages. To a lesser extent, reconfiguration on the Entry Plaza and Annex Lot would also require vegetation removal in the riparian zone. Up to 0.1 acre of temporary disturbance and 0.01 acres of permanent disturbance would occur within area that is considered

critical habitat for Coho . Avoidance and minimization measures VEG-1 would require MWNM to develop a detailed revegetation and rehabilitation plan for enhancing areas disturbed by the Project. Planted areas would be monitored annually after construction for a minimum of five years to determine whether revegetation efforts were successful and if remedial actions are necessary. In addition, many of the measures listed in the previous section to reduce the potential for Project activities to result in erosion and sedimentation would also minimize disturbance to vegetation (e.g., GEN-1, GEN-4, etc.). With implementation of these avoidance and minimization measures potential adverse effects to salmonids resulting from vegetation removal would be insignificant.

Over the long-term, the Project is expected to improve vegetation conditions in this portion of Redwood Creek. As mentioned above, disturbed and eroded banks would be regraded, restored, and revegetated, thereby improving riparian habitat along the creek. Furthermore, reconfiguring the Entry Plaza would allow for approximately 0.4 acre of developed area to be restored and replanted with native vegetation.

7.2 California Red-legged Frog

The action area lacks deep pools or slack water areas required for CRLF breeding, and there are no recorded observances of this species in the action area. Ground disturbing activities associated with installation of the Dipsea Trail bridge and culvert replacements would occur in areas that provide potentially suitable dispersal, foraging, and sheltering habitats for CRLF.

CRLF are not expected to be present in the action area given the distance to known breeding populations (i.e., 1.6 miles downstream near Muir Beach). In the unlikely event that CRLF are present during construction, Project activities would have the potential to adversely affect CRLF through the use of mechanized equipment. Implementation of Measure BIO-7, which requires a pre-construction survey for CRLF, would minimize the potential for CRLF to be harmed during construction. Other potential adverse effects to CRLF or potentially suitable non-breeding habitat would be minimized by implementation of GEN-1 through GEN-4, HYD-2 through HYD-5, outlined above in Section 2.2. In the event that CRLF are observed during Project activities, BIO-7 requires NPS to consult with USFWS to identify further minimization measures. With implementation of these avoidance and minimization measures potential adverse effects to CRLF would be insignificant.

In the long-term effects potential CRLF non-breeding habitat would be enhanced by reducing untreated stormwater runoff into Redwood Creek, stabilizing erosion hazard areas, and revegetating portions of the Entry Plaza.

7.3 Northern Spotted Owl

Most Project activities would occur in existing developed and disturbed areas not suitable for NSO and the Proposed Project would not remove any trees suitable for NSO nesting. Annual surveys track NSO within MWNM and the action area and no territories have been established in MWNM since 2010 (Ellis and Harrigan 2016). However, NSO could nest within or in close proximity to the action area. NSO may also utilize the action area for foraging.

Short-term effects of the Proposed Project would result in an increase above ambient noise levels, which would be audible within suitable NSO habitat in the action area. Construction activities and increased levels of noise, traffic, and human activity may potentially alter the behavior of NSO. As discussed in Section 6.2, MWNM receives nearly 1 million visitors annually. Current configurations of passenger drop-off and shuttle and bus parking areas force large vehicles to make multiple maneuvers to navigate the entry area and merge back onto Muir Woods Road. Many of these larger vehicles are equipped with high-decibel back-up alarms and shuttles often transport and offload large groups near the Entry Plaza. NSO residing in or near MWNM would be habituated to high levels of vehicular and pedestrian traffic and noise in the action area. However, Project-related noise, such as operation of heavy equipment and power tools, may differ from other, daily customary sounds.

The Proposed Project would implement Measure BIO-5 requiring a pre-construction surveys for NSO in suitable nesting habitat. If NSO nests are detected during pre-construction surveys, no work that raises noise levels above ambient background levels shall be conducted within ¼-mile of an active nest. Furthermore, Measure BIO-8 limits potential impacts to dusky-footed woodrats, the main prey base for NSO in Marin County. Implementation of these minimization measure would reduce Project-related effects to NSO to a level that would be insignificant

Long-term effects of the Proposed Project may slightly reduce the ambient noise level by increasing the maneuverability and efficiency in which larger shuttles and busses can navigate the parking lot, reducing the frequency of back-up alarms. This reduction in noise may have beneficial effects to NSO.

7.4 Marbled Murrelet

Surveys for MAMU, including intensive censuses, eggshell surveys, and shore-based surveys, were conducted from 1995 through 1998 with no confirmed observations reported, nor have surveys detected this species in the nearshore waters off of Muir Beach (Gardali and Geupel 2000). MAMU is not expected to occur in the action area. However, a portion of the action area provides marginally suitable nesting habitat for MAMU, and MAMU could nest within or in close proximity to the action area. The Proposed Project would not remove any trees suitable for MAMU nesting.

The Proposed Project would implement Measure BIO-6 requiring a pre-construction surveys for MAMU in suitable nesting habitat within ¼-mile of the Project area. If MAMU nests are detected during pre-construction surveys, no work that raises noise levels above ambient background levels shall be conducted within ¼-mile of an active nest. Implementation of this minimization measure would reduce Project-related effects to MAMU to a level that would be insignificant. If MAMU are absent from the action area, then the Proposed Project would have *no effect* on MAMU.

As discussed above, long-term effects of the Proposed Project may slightly reduce the ambient noise level. This reduction in noise may have beneficial effects to MAMU.

7.5 Effects on Critical Habitat and EFH

Redwood Creek is designated critical habitat for Coho and Steelhead, and critical habitat in areas adjacent to the creek were determined based on vegetation surveys conducted in 2013 and PCEs described in the Final Rule for Designated Critical Habitat, Central California Coast and Southern Oregon/Northern California Coasts Coho Salmon (Figure 2) (Culver 2016). Redwood Creek is also EFH for Coho.

As described previously in this section, the Project may adversely affect the ecological function of critical habitat and EFH during construction by erosion, sedimentation, and vegetation removal. Permanent modification of critical habitat would include the new Dipsea Trail Bridge structure and placement of new energy dissipation for culverts. These modifications would cover approximately 0.01 acre and would be offset by revegetation/restoration of 0.4 acre of developed area in the Entry Plaza adjacent to existing critical habitat. Furthermore, the Proposed Project would improve water quality through stormwater management, reduce erosion potential and subsequent sedimentation, and expand riparian vegetation. Thus, the effects on critical habitat and EFH would be beneficial.

7.6 Cumulative Effects

Cumulative effects are defined differently under ESA and NEPA. Under ESA, cumulative effects are reasonably foreseeable future state, private and tribal activities only. For ESA cumulative effects of future federal actions are not considered. ESA cumulative effects are additive to the environmental baseline (past and ongoing actions and their effects). Conversely, under NEPA, cumulative effects include all past and ongoing actions and their effects that are additive to the effects from all reasonably foreseeable future actions (federal and non-federal) as well.

There are no non-federal activities that are reasonably foreseeable in the action area. For information purposes, it is important to mention that the Proposed Project is part of a larger suite of “One Tam” projects aimed at addressing erosion into Redwood Creek (NPS 2015b). Future projects may include improvements along the Redwood Creek Trail, historic riprap removal along the banks near the action area, and replacement of other pedestrian bridges upstream from the action area. These potential projects would be considered federal actions and are therefore not evaluated under cumulative effects. These activities are anticipated to have short-term affects to ESA-listed species considered in this BA, but are likely to be beneficial in the long-term.

7.7 Interrelated and Interdependent Actions and Their Effects

Interrelated activities are part of the proposed action that depends on the action for their justification, and interdependent activities have no independent utility apart from the action. There no interrelated or interdependent actions associated with this project.

8 EFFECT DETERMINATION SUMMARY

8.1 Coho salmon - Central California Coast ESU

Construction of Project improvements, such as the Dipsea Trail bridge and culvert replacements, would require workers and equipment in within the 100-year flood zone and below the ordinary high mark of Redwood Creek. No dewatering or in-water work is proposed. Impacts associated with implementation of the Proposed Project would be temporary and insignificant and would not result in take of Coho. Therefore, the Proposed Project *may affect, but is not likely to adversely affect* Coho Salmon. In the long-term, the Proposed Project would have beneficial effects for Coho Salmon by improving the water quality of Redwood Creek and habitat conditions.

8.2 Steelhead, Central California Coast DPS

The effects to Steelhead would be similar as those to Coho with long-term outcomes of the Proposed Project being beneficial to habitat conditions. Impacts associated with construction of the Proposed Project would be temporary and insignificant. Therefore, the Proposed Project *may affect but is not likely to adversely affect* Steelhead.

8.3 California Red-legged Frog

The action area lacks suitable breeding habitat for CRLF. This species has not been observed in MWNM and is considered unlikely to occur in the action area. If CRLF did occur in the action area, the avoidance and minimization measures listed in Section 2.2 would further reduce the potential for adverse effects to this species. Thus, the Proposed Project *may affect, but is not likely to adversely affect* California red-legged frog.

8.4 Northern Spotted Owl

NSO have been known to nest within MWNM. A portion of the action area provides suitable nesting and foraging habitat for NSO and this species has the potential to occur in the action area. Potential direct effects to NSO and its habitat would be minimized by implementing the avoidance and minimization measures listed in Section 2.2, including BIO-5, which would require NPS to conduct focused pre-construction surveys of suitable nesting habitat. With implementation of these measures, the Proposed Project *may affect, but is not likely to adversely affect* Northern Spotted Owl.

8.5 Marbled Murrelet

A portion of the action area provides suitable habitat for MAMU. Potential direct effects to MAMU and its habitat would be minimized by implementing the avoidance and minimization measures listed in Section 2.2, including BIO-6, which would require NPS to conduct focused pre-construction surveys of suitable MAMU nesting habitat. If MAMU are not present in the action area, then the Proposed Project would have *no effect* on Marbled Murrelet. If MAMU are detected during pre-construction surveys, NPS will re-initiate consultation with USFWS to determine appropriate avoidance and minimization measures.

8.6 Critical Habitat and EFH

Critical habitat for Coho Salmon and Steelhead is present in the action area. Redwood Creek is designated as EFH for Coho salmon. Permanent modification of 0.01 acre of critical habitat following construction of the new Dipsea Trail Bridge and placement of new energy dissipation for culverts would be offset by revegetation/restoration of 0.4 acre of developed area in the Entry Plaza, resulting in a net addition of 0.39 acre of riparian vegetation adjacent to existing critical habitat. Water quality conditions would be improved through stormwater management enhancements and reduced erosion potential. Therefore, the Proposed Project *may affect, but is not likely to adversely affect* designated critical habitat and EFH.

9 NEED FOR REASSESSMENT BASED ON CHANGED CONDITIONS

This BA and findings above are based on the best current data and scientific information available. A new analysis and revised BA must be prepared if one or more of the following occurs: (1) new species information (including but not limited to a newly discovered activity area or other species information) reveals effects to threatened, endangered, proposed species, or designated/proposed critical habitat in a manner or to an extent not considered in this assessment; (2) the action is subsequently modified or it is not fully implemented as described herein which causes an effect that was not considered in this assessment; or (3) a new species is listed or critical habitat is designated which may be affected by the action that was not previously analyzed herein.

10 LITERATURE CITED

- Allan, J.D., M.S. Wipfli, J.P. Caouette, A. Prussian, and J. Rodgers. 2003. Influence of streamside vegetation on inputs of terrestrial invertebrates to salmonid food webs. *Can. J. Fish. Aquat. Sci.* 60: 309-320.
- Baxter, C. V., K. D. Fausch, and W. C. Saunders. 2005. Tangled webs: reciprocal flows of invertebrate prey link streams and riparian zones. *Freshwater Biology* 50: 201–220.
- California Department of Fish and Game (CDFG). 1996. Steelhead Restoration and Management Plan for California. Report authored by McEwan, Dennis, and Jackson, Terry A. <http://www.dfg.ca.gov/fish/Resources/SteelHead/>. Accessed October 3, 2016.
- California Department of Fish and Game (CDFG). 2004. Recovery strategy for California Coho salmon. Report to the California Fish and Game Commission. <http://www.dfg.ca.gov/fish/Resources/Coho/CohoRecovery.asp>. Accessed October 3, 2016.
- California Department of Fish and Wildlife (CDFW). 2015. Recovery Strategy for California Coho Salmon Progress Report 2004-2012. Report to the California Fish and Game Commission. http://www.fgc.ca.gov/public/reports/FGC_Coho_Report_2015.pdf. Accessed October 5, 2016.
- California Department of Fish and Wildlife (CDFW). 2016. California Natural Diversity Data Base (CNDDB). Online database query. <https://www.wildlife.ca.gov/Data/CNDDB>. Accessed October 5, 2016.
- Carlisle, S., M. Reichmuth, K. Jordan, and K. Church. 2013. Long-term monitoring of Coho salmon and steelhead trout during freshwater life stages in coastal Marin County: 2012 annual report. Natural Resource Technical Report NPS/SFAN/NRTR—2014/887. National Park Service, Fort Collins, Colorado. http://science.nature.nps.gov/im/units/sfan/monitor/coho_steelhead.cfm. Accessed October 5, 2016.
- Carlisle, S., and M. Reichmuth. 2015. Long term monitoring of coho salmon and steelhead trout during freshwater life stages in coastal Marin County: 2011 annual report. Natural Resource Report NPS/SFAN/NRR—2015/969. National Park Service, Fort Collins, Colorado. http://science.nature.nps.gov/im/units/sfan/monitor/coho_steelhead.cfm. Accessed October 5, 2016.
- Carlisle, S., M. Reichmuth, and B. McNeill. 2016. Long-term monitoring of coho salmon and steelhead during freshwater life stages in coastal Marin County: 2014 annual report. Natural Resource Report NPS/SFAN/NRR—2016/1142. National Park Service, Fort Collins, Colorado. CDFG. See California Department of Fish and Game. http://science.nature.nps.gov/im/units/sfan/monitor/coho_steelhead.cfm. Accessed October 5, 2016.

CDFW. See California Department of Fish and Wildlife.

Coopridge, Mary. 2004. San Francisco Area Network Preliminary Water Quality Status Report. National Park Service. December. http://www.sfnps.org/download_product/1401/0. Accessed October 5, 2016.

Culver, Steven. 2016. Methodology for Mapping Coho Critical Habitat within the MUWO Site Improvement Project Area. Draft report. Prepared for Golden Gate National Recreation Area.

Ellis, T, and K. Harrigan. 2016. Monitoring northern spotted owls on federal lands in Marin County, California: 2013 report. Natural Resource Report NPS/SFAN/NRR—2016/1180. National Park Service, Fort Collins, Colorado. http://science.nature.nps.gov/im/units/sfan/monitor/spotted_owls.cfm. Accessed October 5, 2016.

Environmental Protection Agency (EPA). 1999. Storm Water Technology Fact Sheet: Infiltration Trench. EPA 832-F-99-019.

Evans Mack, D., W. P. Ritchie, S. K. Nelson, E. Kuo-Harrison, P. Harrison, and T. E. Hamer. 2003. Methods for surveying Marbled Murrelets in forests: a revised protocol for land management and research. Pacific Seabird Group. https://www.pacificseabirdgroup.org/publications/PSG_TechPub2_MAMU_ISP.pdf. Accessed October 10, 2016.

Gardali, Thomas and Geupel, Geoffrey R. 2000. Bird monitoring in the Muir Woods National Monument: summary of results from 1997-1999 and suggested long-term monitoring plan. Final Report. Point Reyes Bird Observatory. May. http://www.sfnps.org/download_product/1718/0. Accessed October 3, 2016.

GGNRA. See Golden Gate National Recreation Area.

Golden Gate National Recreation Area (GGNRA). 2016. General Park Operations for Golden Gate National Recreation Area (excluding areas managed by Point Reyes National Seashore). April.

Hayes, M. P., & Tennant, M. R. 1985. Diet and feeding behavior of the California red-legged frog, *Rana aurora draytonii* (Ranidae). The Southwestern Naturalist. 30(4).

Holland, R.F. 1986. Preliminary descriptions of the terrestrial natural communities of California. California Department of Fish and Game. October. <http://www.cal-ipc.org/ip/inventory/pdf/HollandReport.pdf>. Accessed October 10, 2016.

Kawaguchi, Y. S. Nakano, and Y. Taniguchi. 2003. Terrestrial invertebrate inputs determine the local abundance of stream fishes in a forested stream. Ecology 84: 701–708.

Kelly, E. G., E. D. Forsman, and R. G. Anthony. 2003. Are Barred Owls Displacing Spotted Owls? The Condor 105:45–53.

- Ketcham, B.J., Reichmuth, M., and Leising, K.L. 2005. Long-term coho salmon and steelhead trout monitoring program in Coastal Marin County – Summer 2005 monitoring progress report. California Department of Fish and Game Contract #P0330431. PORE NR/WR-05/04 40pp. http://science.nature.nps.gov/im/units/sfan/monitor/coho_steelhead.cfm. Accessed October 5, 2016.
- Lannoo, M. 2005. Amphibian Declines, The Conservation Status of United States Species. University of California Press, Berkeley.
- Madej, M. A. 2010. Analysis of trends in climate, streamflow, and stream temperature in north coastal California. Bull Creek near Weott USGS Humboldt. 1961:72–8.
- McBride, J. and D. Jacobs. 1978 The History of the Vegetation at Muir Woods National Monument. Prepared for the National Park Service, San Francisco, California.
- McCormick, D. P. and S. S. C. Harrison. 2011. Direct and indirect effects of riparian canopy on juvenile Atlantic salmon, *Salmo salar*, and brown trout, *Salmo trutta*, in south-west Ireland. Fisheries Management and Ecology 18(6): 444–455.
- Moyle, Peter B., Israel, Joshua A., and Purdy, Sabra E. 2008. Salmon, Steelhead, and Trout in California, Status of an Emblematic Fauna. Report commissioned by California Trout. UC Davis Center for Watershed Sciences. <https://watershed.ucdavis.edu/pdf/SOS-Californias-Native-Fish-Crisis-Final-Report.pdf>. Accessed October 5, 2016.
- Murphy, M.L. and W.R. Meehan. 1991. Stream ecosystems. In: W.R. Meehan (ed.), “Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats.” American Fisheries Society, Special Publication 19. Bethesda, Maryland, 17–46.
- National Oceanic and Atmospheric Administration (NOAA). 2011. 5-Year Review: Summary and Evaluation of Central California Coastal Steelhead DPS Northern California Steelhead DPS. November. Accessed May 5, 2016; http://www.nmfs.noaa.gov/pr/pdfs/species/ccc_nc_steelhead_5yearreview.pdf.
- National Oceanic and Atmospheric Administration (NOAA). 2012. Final Recovery Plan for Central California Coast Coho salmon Evolutionarily Significant Unit. National Marine Fisheries Service, Southwest Region, Santa Rosa, California.
- National Oceanic and Atmospheric Administration (NOAA). 2015. Public Draft Coastal Multispecies Recovery Plan. National Marine Fisheries Service, West Coast Region, Santa Rosa, California.
- National Oceanic and Atmospheric Administration (NOAA). 2016. 5-Year Review: Summary and Evaluation of Central California Coho Salmon. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, West Coast Region. April. http://www.westcoast.fisheries.noaa.gov/publications/status_reviews/salmon_steelhead/2016/2016_ccc-coho.pdf. Accessed October 10, 2016.

- National Park Service (NPS). 2005. Fire Management Plan Final Environmental Impact Statement. Golden Gate National Recreation Area. November.
<https://parkplanning.nps.gov/document.cfm?parkID=303&projectID=13822&documentID=13599>. Accessed October 10, 2016.
- National Park Service (NPS). 2006. National Park Service Management Policy.
<https://www.nps.gov/policy/MP2006.pdf>. Accessed October 10, 2016.
- National Park Service (NPS). 2011. Redwood Creek Watershed Assessment. Prepared by Stillwater Sciences and Horizon Water and Environment, LLC. August.
<https://www.nps.gov/goga/learn/management/redwood-creek-watershed-assessment.htm>. Accessed October 10, 2016.
- National Park Service (NPS). 2013. Buckeye community report. Steers, pers. comm.
- National Park Service (NPS). 2014. Golden Gate National Recreation Area and Muir Woods National Monument Final General Management Plan / Environmental Impact Statement.
<http://parkplanning.nps.gov/document.cfm?parkID=303&projectID=15075&documentID=58777>.
- National Park Service (NPS). 2015a. Muir Woods National Monument Reservation System Environmental Assessment.
<https://parkplanning.nps.gov/documentsList.cfm?projectID=48272>. Accessed October 10, 2016.
- National Park Service (NPS). 2015b. Muir Woods, Dipsea Bridge Report. Draft. Prepared by Wallace Roberts & Todd, LLC. November.
- National Park Service (NPS). 2016. Delineation of Wetlands and “other Waters” Redwood Creek and Vicinity, Muir Woods National Monument Golden Gate National Recreation Area.
- National Parks Conservation Association (NPCA). 2009. Muir Woods National Monument State of the Parks Natural Resources Assessment. Report Prepared for the National Parks Conservation Association Center for State of the Parks.
- National Parks Conservation Association (NPCA). 2011 Muir Woods National Monument: A Resource Assessment. State of the Parks. 36 pp.
<https://www.nps.gov/muwo/learn/management/upload/State-of-the-Parks-MUWO-by-NPCA.pdf>. Accessed October 10, 2016.
- Natural Resources Conservation Service (NRCS). 2016. Web Soil Survey. Available:
<http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>. Accessed April 27, 2016.
- NOAA. See National Oceanic and Atmospheric Administration.

- Northern Hydrology and Engineering. 2015. Preliminary Assessment of relocating the lower portion of the Conlon/Camino del Cañon. Prepared for the National Park Service.
- NPCA. See National Parks Conservation Association.
- NPS. See National Park Service.
- NRCS. See Natural Resources Conservation Service.
- Pacific Fisheries Management Council. 2016. Pacific Coast Salmon Fishery Management Plan for Commercial And Recreational Salmon Fisheries off the Coasts of Washington, Oregon, and California, as Revised Through Amendment 19. March
- Press, D., D. Adams, H. Jensen, K. Fehring, W. Merkle, M. Koenen, and L. A. Starcevich. 2010. San Francisco Bay Area Network northern spotted owl monitoring protocol: Version 6.4. Natural Resource Report NPS/SFAN/NRR—2010/245. National Park Service, Fort Collins, Colorado. http://science.nature.nps.gov/im/units/sfan/monitor/spotted_owls.cfm. Accessed October 5, 2016.
- Ralph, C.J., S.K. Nelson, M.M. Shaughnessy, S.L. Miller, and T.E. Hamer. 1994. Methods for surveying Marbled Murrelets in forests: a protocol for land management and research. Pacific Seabird Group, Marbled Murrelet Technical Committee. March 1994. 51 pp.
- Reichmuth, M., B.J. Ketcham, D. Fong, S. Carlisle, E. Brown, and M. Koenen. 2010. Salmonid monitoring protocol for the San Francisco Area Network: standard operating procedures - version Natural Resource Report NPS/SFAN/NRR—2010/203. National Park Service, Fort Collins, Colorado. http://science.nature.nps.gov/im/units/sfan/monitor/coho_steelhead.cfm. Accessed October 5, 2016.
- Reichmuth, M., S. Carlisle, A. Dedrick, and A. Rodoni. 2016. Long-term monitoring of coho salmon and steelhead trout during freshwater life stages in coastal Marin County: 2009 annual report. Natural Resource Report NPS/SFAN/NRR—2016/1212. National Park Service, Fort Collins, Colorado. http://science.nature.nps.gov/im/units/sfan/monitor/coho_steelhead.cfm. Accessed October 5, 2016.. Accessed October 5, 2016.
- Sawyer, J.O., Keeler-Wolf, T., and Evens, J.M. 2009. A Manual of California Vegetation. 2nd Edition. California Native Plant Society Press. Sacramento, California.
- Stadler, J., Griffin, K., Chavez, E., Spence, B., Roni, P., Gavette C., Seekins, B., and Obaza, A. 2011. Pacific Coast Salmon 5-Year Review of Essential Fish Habitat, Final Report to the Pacific Fishery Management Council. Prepared by National Marine Fisheries Service and Pacific Fishery Management Council. Accessed April, 2016; http://www.westcoast.fisheries.noaa.gov/publications/protected_species/salmon_steelhead/efh/info_sup_rpt3_att1_efh_jun2011bb.pdf

- Stebbins, R.C. 2003. A Field Guide to Western Reptiles and Amphibians. Third Edition. Peterson Field Guides. Houghton Mifflin Company, Boston Mass.
- Steers, Robert. 2013. Vegetation Resource Surveys in Muir Woods National Monument, Parking Alternatives Project: Results of Vegetation Mapping, Floristic Surveys, and Focused Rare Plant Species Surveys. Prepared for Golden Gate National Recreation Area. July.
- U.C. Davis. 2016a. Species description for Central Coast Coho Salmon. University of California, Division of Agriculture and Natural Resources. California Fish Website. <http://calfish.ucdavis.edu/species/?uid=25&ds=698>. October 10, 2016.
- U.C. Davis. 2016b. Species description for Central California Coast Winter Steelhead. University of California, Division of Agriculture and Natural Resources. California Fish Website. <http://calfish.ucdavis.edu/species/?uid=23&ds=698>. October 10, 2016.
- U.S. Fish and Wildlife Service (USFWS). 1997. Recovery Plan for the Threatened Marbled Murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California. Portland, Oregon. https://www.fws.gov/arcata/es/birds/mm/m_murrelet.html. Accessed October 3, 2016.
- U.S. Fish and Wildlife Service (USFWS). 2002. Recovery Plan for the California Red-legged Frog (*Rana aurora draytonii*). U.S. Fish and Wildlife Service, Portland, Oregon. https://ecos.fws.gov/docs/recovery_plan/020528.pdf. Accessed October 3, 2016.
- U.S. Fish and Wildlife Service (USFWS). 2005. Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog. August. https://www.fws.gov/sacramento/es/survey-protocols-guidelines/documents/crf_survey_guidance_aug2005.pdf. Accessed October 10, 2016.
- U.S. Fish and Wildlife Service (USFWS). 2008. Final Recovery Plan for the Northern Spotted Owl, *Strix occidentalis caurina*. U.S. Fish and Wildlife Service, Portland, Oregon. <http://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=B08B>. Accessed October 3, 2016.
- U.S. Fish and Wildlife Service (USFWS). 2016a. Sacramento Fish and Wildlife Office. Information for Planning and Conservation Report for the Project Area. <https://ecos.fws.gov/ipac/project/CT7UCLY2VVE3JJ7S6ED7SL55Xl/regulatoryDocuments>. Accessed October 8, 2016.
- U.S. Fish and Wildlife Service (USFWS). 2016b. Species Profile for Steelhead (*Oncorhynchus* (=salmo) *mykiss*). Environmental Conservation Online System (ECOS). http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E08D. Accessed October 10, 2016.

11 LIST OF PREPARERS

Consultant Group

Prepared by: Kevin Fisher, M.S., PWS and Brian Piontek, M.S.
Horizon Water and Environment, LLC
180 Grand Avenue, Suite 1405
Oakland, CA 94612
(510) 986-5420

Senior reviewer: Michael Stevenson, M.S., Principal
Horizon Water and Environment, LLC

Appendix A
USFWS Information for Planning and
Conservation Report



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Sacramento Fish and Wildlife Office

FEDERAL BUILDING, 2800 COTTAGE WAY, ROOM W-2605

SACRAMENTO, CA 95825

PHONE: (916)414-6600 FAX: (916)414-6713



Consultation Code: 08ESMF00-2017-SLI-0049

October 08, 2016

Event Code: 08ESMF00-2017-E-00083

Project Name: Muir Woods Sustainable Access Project

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2)

of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm>; <http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment



United States Department of Interior
Fish and Wildlife Service

Project name: Muir Woods Sustainable Access Project

Official Species List

Provided by:

Sacramento Fish and Wildlife Office
FEDERAL BUILDING
2800 COTTAGE WAY, ROOM W-2605
SACRAMENTO, CA 95825
(916) 414-6600

Consultation Code: 08ESMF00-2017-SLI-0049

Event Code: 08ESMF00-2017-E-00083

Project Type: RECREATION CONSTRUCTION / MAINTENANCE

Project Name: Muir Woods Sustainable Access Project

Project Description: The National Park Service (NPS) is proposing to improve visitor access and arrival facilities at Muir Woods National Monument (MWNM) in Marin County, California. The Proposed Project would modify the footprints of existing parking areas, but maintain the same number of parking spaces for privately owned vehicles as currently exists (i.e., 232 spaces). Existing parking spaces would be relocated and approximately 0.4 acre would be rehabilitated with native riparian vegetation.

The Main Lot would also maintain its existing footprint and contain approximately 18 parking spaces for buses, shuttles, and commercial use vehicles.

The Annex Lot would be reconfigured and restriped to accommodate approximately 125 parking spaces for privately owned vehicles. The Annex Lot would be designed with one-way aisles and a single entry and exit at the southern end of the lot to promote efficient vehicular circulation.

The Conlon Lot would be widened 6 to 8 feet to accommodate a two-way driveway and approximately 48 parking spaces for privately owned vehicles. A pedestrian trail would be developed on the perimeter of the lot near Conlon Creek. Existing roadside parking would be eliminated on the east side of Muir Woods Road between Conlon Avenue and the Muir Woods Road Bridge, and the area would be revegetated with plants native to MWNM.

A new lot would be developed in the former Nursery Area—also referred to as the Nursery Lot—and contain parking spaces for up to 48 privately owned vehicles. The structures in the former Nursery Area would be removed, and the area would require less than 0.3 acre of development. One culvert would be installed during construction to accommodate an existing drainage on site. Impervious asphalt would be used to surface the Nursery Lot, and the lot would be designed to



United States Department of Interior
Fish and Wildlife Service

Project name: Muir Woods Sustainable Access Project

promote one-way traffic with one entrance, one exit, and a single driveway.

Engineered stormwater management facilities would be used to treat the runoff from the Entry Plaza and all parking lots. Two existing culvert outfall areas would be stabilized and restored to reduce the ongoing effects of erosion.

The Proposed Project would remove the restroom near Redwood Creek in the Entry Plaza. The restroom would remain in the Entry Plaza but be relocated outside of the erosion hazard area. A second restroom would be constructed near the former Nursery Area.

Several existing pedestrian trails would be decommissioned and revegetated, with construction of several new trails connecting the new lots. Approximately 1,200 linear feet of disturbance would be required to construct the trails at a width of 6 to 8 feet. Small footbridges or boardwalks would be built over any intermittent drainages along the trail route.

A new pedestrian footbridge would be installed at the Dipsea Trail/Redwood Creek crossing. No trees would need to be removed and the existing Dipsea Trail would retain a similar alignment. Timing of this project would range from 2017-2020, with construction-related activities mostly limited to the summer months.

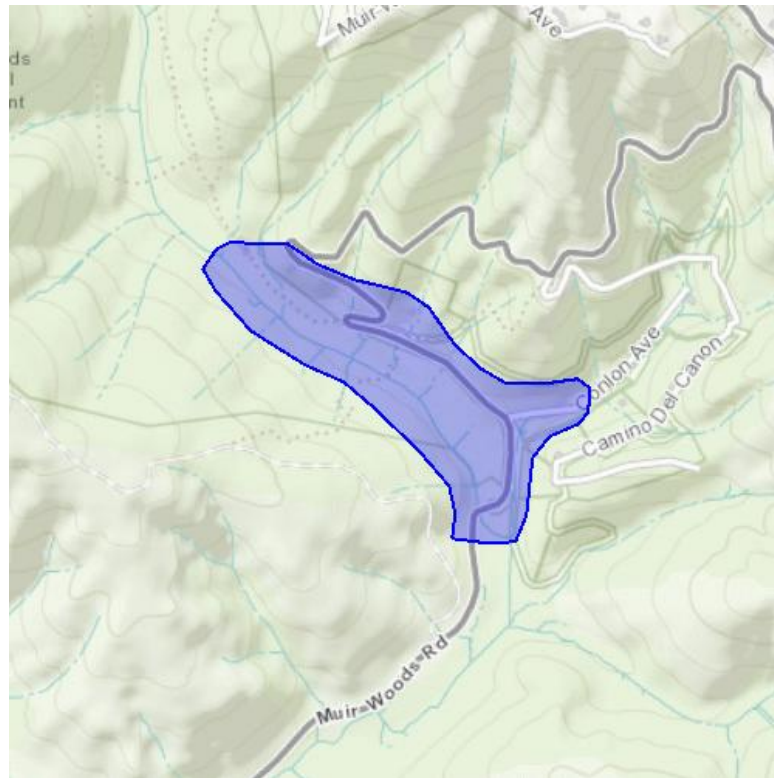
Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.



United States Department of Interior
Fish and Wildlife Service

Project name: Muir Woods Sustainable Access Project

Project Location Map:



Project Coordinates: The coordinates are too numerous to display here.

Project Counties: Marin, CA



United States Department of Interior
Fish and Wildlife Service

Project name: Muir Woods Sustainable Access Project

Endangered Species Act Species List

There are a total of 18 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Amphibians	Status	Has Critical Habitat	Condition(s)
California red-legged frog (<i>Rana draytonii</i>) Population: Wherever found	Threatened	Final designated	
Birds			
California Clapper rail (<i>Rallus longirostris obsoletus</i>) Population: Wherever found	Endangered		
California Least tern (<i>Sterna antillarum browni</i>) Population: Wherever found	Endangered		
Marbled murrelet (<i>Brachyramphus marmoratus</i>) Population: U.S.A. (CA, OR, WA)	Threatened	Final designated	
Northern Spotted owl (<i>Strix occidentalis caurina</i>) Population: Wherever found	Threatened	Final designated	
Short-Tailed albatross (<i>Phoebastria (=diomedea) albatrus</i>) Population: Wherever found	Endangered		



United States Department of Interior
Fish and Wildlife Service

Project name: Muir Woods Sustainable Access Project

western snowy plover (<i>Charadrius nivosus</i> ssp. <i>nivosus</i>) Population: Pacific Coast population DPS&U.S.A. (CA, OR, WA), Mexico (within 50 miles of Pacific coast)	Threatened	Final designated	
Fishes			
Delta smelt (<i>Hypomesus transpacificus</i>) Population: Wherever found	Threatened	Final designated	
steelhead (<i>Oncorhynchus</i> (=salmo) <i>mykiss</i>) Population: Northern California DPS	Threatened		
Tidewater goby (<i>Eucyclogobius newberryi</i>) Population: Wherever found	Endangered	Final designated	
Flowering Plants			
Marin dwarf-flax (<i>Hesperolinon congestum</i>) Population: Wherever found	Threatened		
Santa Cruz tarplant (<i>Holocarpha macradenia</i>) Population: Wherever found	Threatened	Final designated	
Showy Indian clover (<i>Trifolium amoenum</i>) Population: Wherever found	Endangered		
White-Rayed pentachaeta (<i>Pentachaeta bellidiflora</i>) Population: Wherever found	Endangered		
Insects			



United States Department of Interior
Fish and Wildlife Service

Project name: Muir Woods Sustainable Access Project

Mission Blue butterfly (<i>Icaricia icarioides missionensis</i>) Population: Wherever found	Endangered		
Myrtle's Silverspot butterfly (<i>Speyeria zerene myrtleae</i>) Population: Wherever found	Endangered		
San Bruno Elfin butterfly (<i>Callophrys mossii bayensis</i>) Population: Wherever found	Endangered		
Mammals			
Salt Marsh Harvest mouse (<i>Reithrodontomys raviventris</i>) Population: wherever found	Endangered		



United States Department of Interior
Fish and Wildlife Service

Project name: Muir Woods Sustainable Access Project

Critical habitats that lie within your project area

The following critical habitats lie fully or partially within your project area.

Birds	Critical Habitat Type
Marbled murrelet (<i>Brachyramphus marmoratus</i>) Population: U.S.A. (CA, OR, WA)	Final designated

U.S. Fish and Wildlife Service (USFWS). 2016c. Species Profile for Steelhead (*Oncorhynchus* (=salmo) *mykiss*). Environmental Conservation Online System (ECOS). http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E08D. Accessed October 10, 2016.

USFWS. See U.S. Fish and Wildlife Service.

U.S. Geological Survey (USGS). 2015. San Rafael Quadrangle, California-Marin County. 7.5-Minute Series.

U.S. Geological Survey (USGS). 2016. National Water Information System Data for USGS Station 11460151, Redwood C A Hwy 1 Bridge A Muir Beach Ca. http://waterdata.usgs.gov/nwis/inventory/?site_no=11460151&agency_cd=USGS. Accessed September 29, 2016.

USGS. See U.S. Geological Survey.

Western Regional Climate Center (WRCC). 2016. Climate Summary for Muir Woods, California, (046027). <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca6027>. Accessed October 5, 2016. Wootton, J.T. 2012. River Food Web Response to Large-Scale Riparian Zone Manipulations. PLoS ONE 7(12): e51839. Available: www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0051839. Accessed: April 2015.

Appendix B
Methodology for Mapping Coho Critical
Habitat within the MUWO Site Improvement
Project Area

**Methodology for Mapping Coho Critical Habitat
within the MUWO Site Improvement Project Area**
Prepared by Steven Culver, NPS

The following summarizes the methodology used to map coho critical habitat within the Muir Woods National Monument (MUWO) Site Improvement Project Area. Robert Steers (Vegetation Ecologist, San Francisco Bay Area Network, Inventory and Monitoring Program) mapped vegetation on the northwest side of Redwood Creek in the MUWO site improvement project area (Steers 2013). As part of this effort, Steers also mapped coho critical habitat for the adjacent riparian area based on primary constituent elements (PCE) described in the Final Rule for Designated Critical Habitat, Central California Coast and Southern Oregon/Northern California Coasts Coho Salmon (Federal Register 73(28):7816-7873). An 85-foot stream buffer from the edge of Redwood Creek was later added to this coho critical habitat polygon on both sides of Redwood Creek (see Coho Salmon Critical Habitat map). The bankfull edge of Redwood Creek was delineated by Amelia Ryan (PORE, Wetland Ecologist) as part of the wetland mapping of the project area. The buffer width was based on the final rule that states "NMFS is redefining coho salmon critical habitat based on key riparian functions. Specifically, the adjacent riparian area is defined as the area adjacent to a stream that provides the following functions: shade, sediment, nutrient or chemical regulation, streambank stability, and input of large woody debris or organic matter." The final rule also states that "fully protected riparian management zones one site-potential tree would adequately maintain 90 to 100 percent of most key riparian functions of Pacific Northwest forests if the goal was to maintain instream processes over a time frame of years to decades." Using Light Detection and Ranging (or LiDAR) data, the maximum vegetation canopy height within the project riparian area that could be affected (removed) by any of the MUWO Sustainable Access Project alternatives was 85 feet or less (see Redwood Creek Canopy: Maximum Height map). Maximum canopy height adjacent to the stream was taller (108 feet), but the proposed action would not affect this streamside vegetation. GIS was used to map a 85-foot wide stream buffer then merged with Steer's critical habitat polygon. Parking areas and adjacent trails were clipped from this polygon because they are not a PCE for coho critical habitat. Mean vegetation canopy height for each vegetation type was also mapped (see Redwood Creek Canopy: Mean Height map). Table 1 lists maximum and mean vegetation canopy height within the project area. This information was considered during alternatives development for the Sustainable Access Project.

**Table 2: Summary of Vegetation Canopy Heights by Vegetation Type
within the MUWO Site Improvement Project Area**

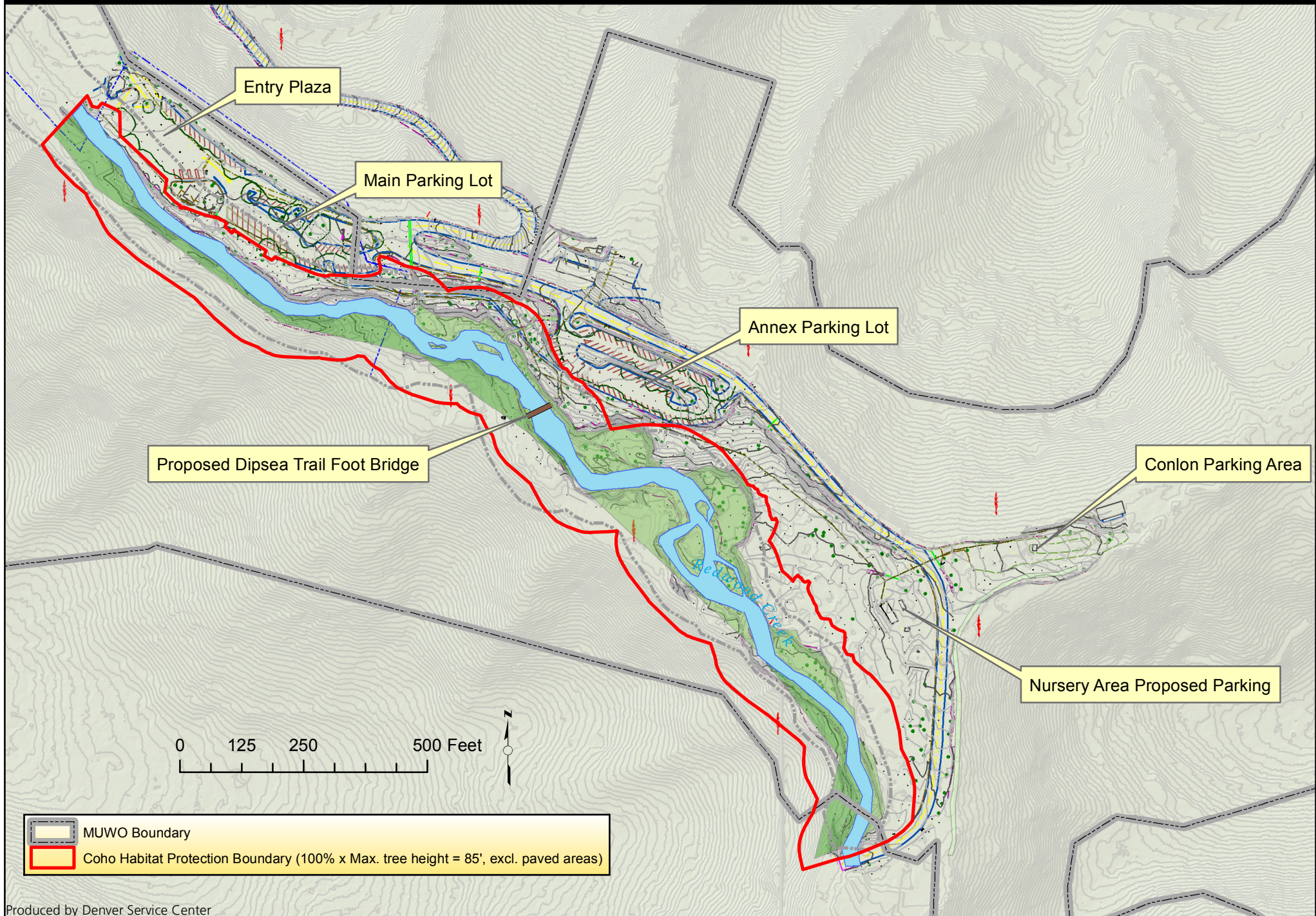
Vegetation Type	Max (m)	Mean (m)	Std. Dev.	Max (ft)	Mean (ft)
Arroyo Willow Riparian Forest	26.2	5.1	3.5	85.8	16.7
Douglas-fir Forest	44.7	15.9	9.1	146.7	52.2
Coast Live Oak Woodland	24.4	6.3	3.9	80.0	20.6
Red Alder Riparian Forest	33.4	12.2	7.6	109.6	40.2
Coyote Bush Coastal Scrub	11.4	1.2	1.7	37.3	4.0
Buckeye - Bay Laurel Forest	26.3	9.6	5.3	86.2	31.4
Douglas-fir / Coast Live Oak Forest	38.6	13.4	8.6	126.7	44.0
Buckeye Forest	15.2	6.1	3.2	50.0	20.0
Urban Mix Forest	30.2	6.8	7.6	99.2	22.3
Bay Laurel Riparian Forest	27.8	8.4	6.7	91.1	27.5
Redwood Forest	59.4	19.4	15.4	195.0	63.8
Bay Laurel - Redwood Forest	28.6	15.9	6.6	93.7	52.2
Douglas-fir / Bay Laurel Forest	49.1	21.6	10.6	160.9	70.9

Sustainable Access Project - Coho Salmon Critical Habitat Boundary

Muir Woods National Monument

Golden Gate National Recreation Area, California

National Park Service
U.S. Department of the Interior

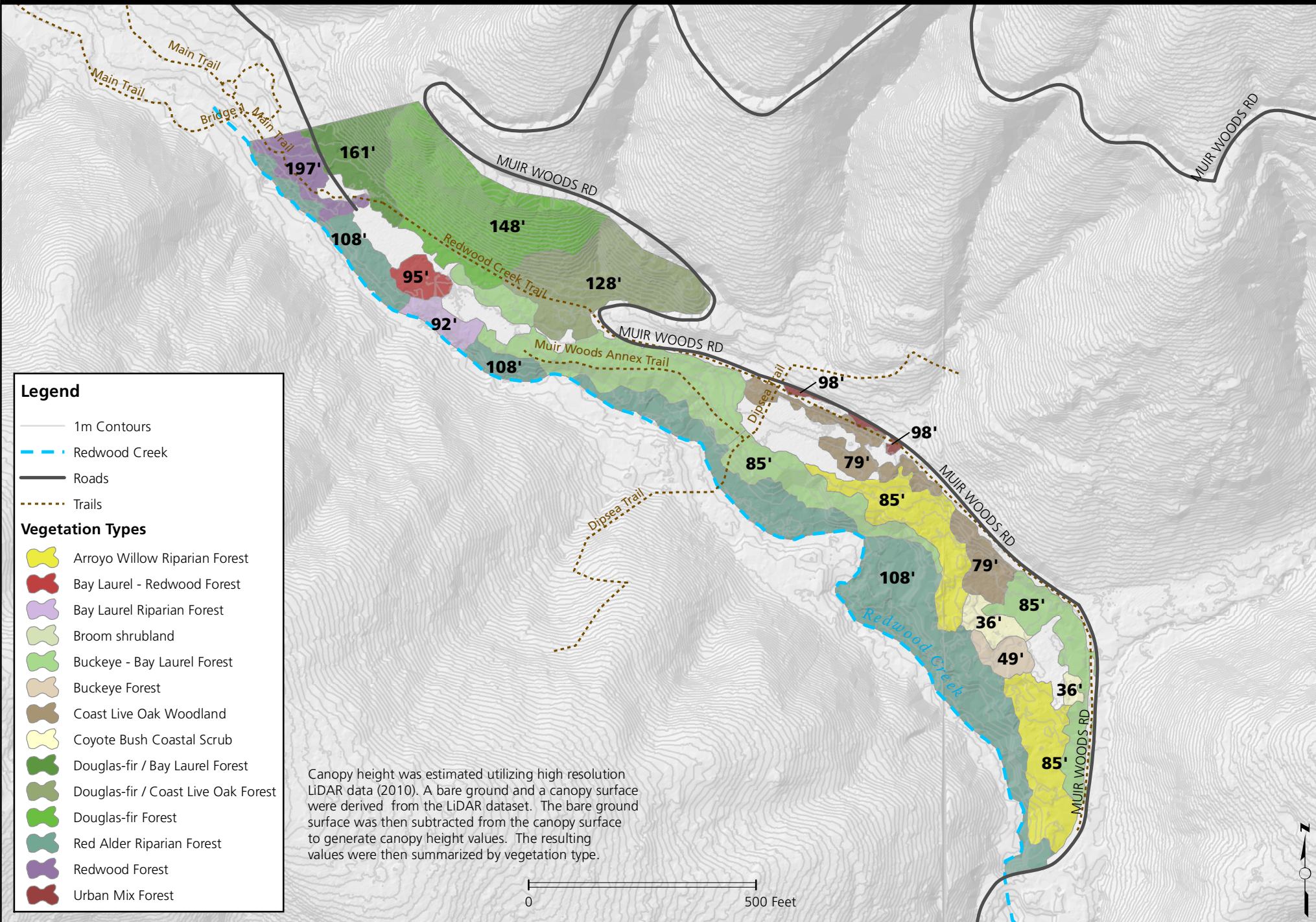


Redwood Creek Canopy: Max Height

Muir Woods National Monument

Golden Gate National Recreation Area, California

National Park Service
U.S. Department of the Interior

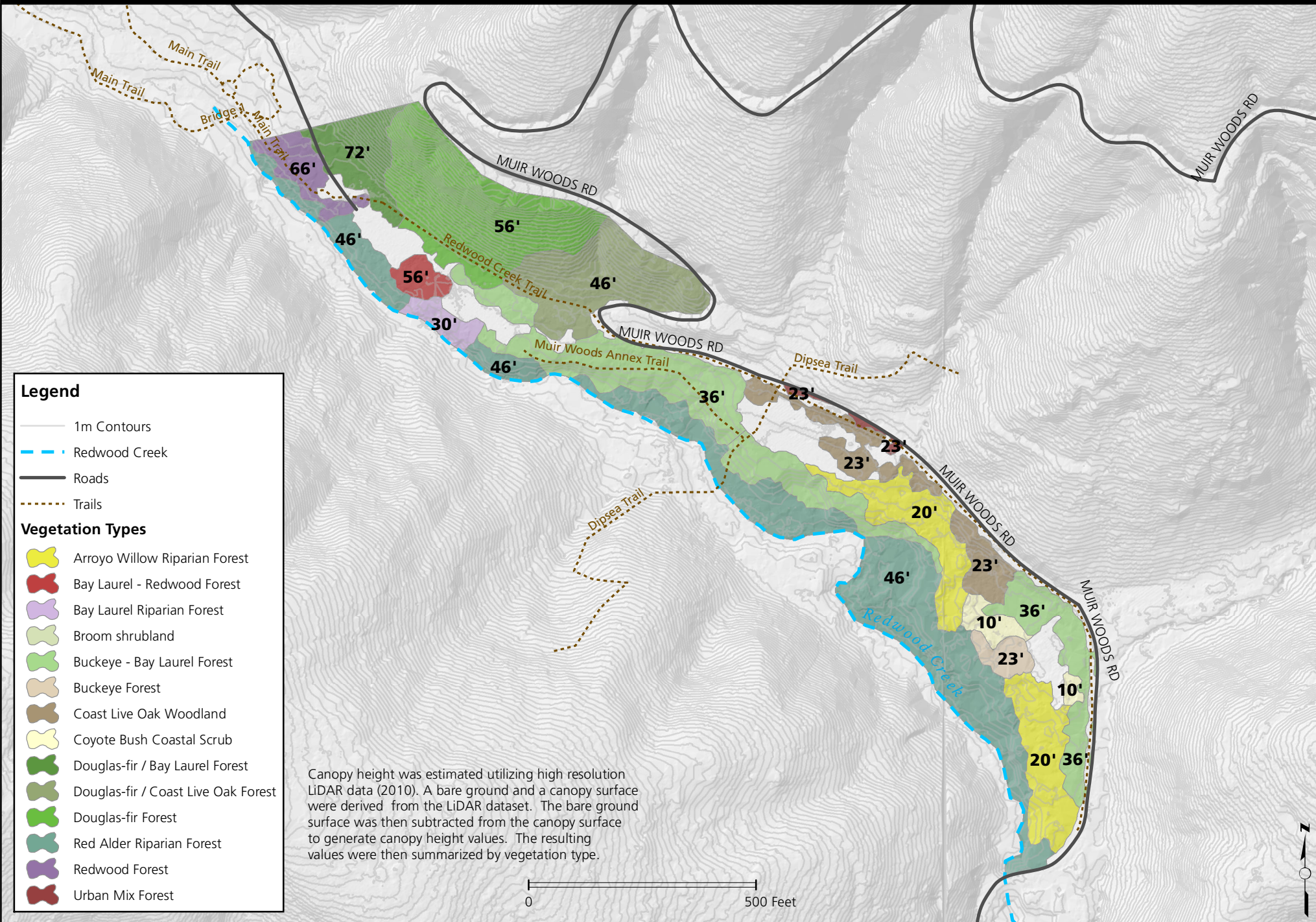


Redwood Creek Canopy: Mean Height

Muir Woods National Monument

Golden Gate National Recreation Area, California

National Park Service
U.S. Department of the Interior





As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.