Redwood
National Park

National Park Service
US Department of the Interior

Streelow Creek Trail Improvements Environmental Assessment

Redwood National Park
Humboldt County, California
March 2010

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Introduction

Redwood National Park was established by Congress in 1968 to "preserve significant examples of the coastal redwood … forests and the streams … with which they are associated for purposes of public inspiration, enjoyment, and scientific study." [Public Law 90-245, Section 3(e)].

Congress expanded Redwood National Park in 1978, in part "to establish a more meaningful Redwood National Park for the use and enjoyment of visitors" (Public Law 95-250). The expansion area included about 48,000 acres, most of which had been logged and which included a dense network of roads that had been constructed to provide access to timber harvest areas and to haul logs on trucks to mills. Many of the roads at the time of park expansion had already been abandoned and were no longer being maintained. The combined effects of intensive logging, a dense network of logging roads, and flood-producing storms between 1955 and 1983 severely damaged aquatic and riparian habitat throughout Redwood Creek watershed.

The legislation expanding the park authorized the National Park Service (NPS) to develop a program for the rehabilitation of logged and roaded watersheds "to reduce risk of damage to streamside areas and for other purposes" (Public Law 95-250, Section 101(a) (6)). Since 1978, the NPS has been conducting watershed restoration activities in accordance with the legislation.

The 1999 Redwood National and State Parks *Final General Management Plan/General Plan, Final Environmental Impact Statement/Environmental Impact Report* (RNSP GMP/FEIS) described a program to remove or upgrade abandoned logging roads to reduce the potential for erosion at stream crossings and from unstable road segments. The proposed action to improve a trail that was established on an abandoned logging road would be implemented as part of the watershed restoration program described in the GMP. This environmental assessment (EA) is tiered off the GMP/FEIS.

Background

The Streelow Creek Trail is a 1.8-mile-long hiking and bicycle trail established on old logging roads adjacent to the creek. Logging in the Streelow Creek watershed and maintenance of logging roads ceased upon creation of Redwood National Park in 1968. Regular maintenance is no longer protecting the roads from degradation and erosion processes.

The roads were built the early 1960s to lower standards than current requirements in the California Forest Practice Rules. Drainage structures at stream crossings and along roads were not designed for effective protection of water quality and aquatic habitat from run-off of excessive sediment from road surfaces and stream crossings. The drainage structures were too few in number and too small to accommodate high flow events.

Road failures can occur at stream crossings and along the road segments between stream crossings when roads are not designed or maintained for effective drainage. Stream crossings are places where roads cross streams or drainage channels. Crossings contain road fill and a drainage structure such as a culvert to allow stream flow to pass under the road. Road fill is placed on top of the drainage structure to create a roadbed.

When streamflow exceeds the capacity of a drainage structure, the excess water can saturate the road and erode the fill, which causes slumps and holes in the roadbed. At higher flows, the stream can overtop the road fill and erode it, causing the road fill to fail. When a stream crossing fails, the road fill in the crossing and the sediment accumulated upstream of the crossing erodes, or the stream diverts out of its original channel and flows down the road or hillslopes, creating gullies or initiating landslides. Sediment eroded from failed roads and stream crossings eventually ends up in the stream.

Stream crossing drainage structures built during the 1960s were not large enough to accommodate 100-year flow events. Many smaller streams crossings were built without drainage structures, with road fill placed directly into channels. On some roads, logs were often placed in the stream channel instead of culverts to allow passage of water during normal low flow periods. Crossings constructed with logs as drainage structures are commonly referred to as "Humboldt" crossings.

Along the northern California coast, culverts have a useful life of about 25-30 years. Culvert bottoms eventually rust through as rocks transported during high flows abrade the bottom of the pipe and remove the protective zinc coating. The unprotected exposed iron corrodes, allowing streamflow to leak from the culvert, which saturates and destabilizes the road fill.

Road segments between stream crossings can also deliver sediment to streams. Road failures occur where road fill is over-steepened, resulting in landslide erosion when saturated road fill slides down a slope. Road failures also occur without proper road surface drainage. Surface runoff during large storms can concentrate on the road surface and cause gully erosion along the road, or saturate the road fill which causes slumps and/or holes in the roadbed or landslide erosion. If a road segment is next to a stream, a road-related landslide will deliver sediment directly to the stream.

The proximity of a road to a stream was not a concern when the Streelow Creek roads were constructed. Sediment delivery to the mainstem of Streelow Creek from failing roads with inadequate drainage is nearly direct because the roads are generally 30-50 feet above Streelow Creek and sometimes less than 100 feet from the active channel of the creek.

Streelow Creek is a tributary of Prairie Creek which is the largest tributary of Redwood Creek (Figure 1). Streelow Creek and Prairie Creek contain some of the best remaining rearing and spawning habitat for salmonids in the park and the region. Three species of anadromous salmonids listed as threatened under the federal Endangered Species Act occupy these streams. Anadromous salmonids spend most of their adult lives in the ocean and migrate from the ocean to spawn in the same freshwater streams in which they were born. These fish require clean spawning gravels that are free of fine sediment to allow the eggs and early life stages to obtain sufficient oxygen to survive. Streelow Creek is designated critical habitat for coho salmon and steelhead.

The Streelow Creek Trail is bisected by the North Fork of Streelow Creek where a foot bridge was installed in summer 2008 (NPS 2007) to replace failing culverts that threatened the long-term stability of the trail (Figure 2). West of the North Fork foot bridge, the road is no longer accessible to motor vehicles and is used only as a trail. East of the North Fork, the road is used both as the Streelow Creek Trail and for administrative vehicle access for future watershed restoration in the Streelow Creek area.

Purpose and Need for Action

Numerous locations along the roads that serve as the Streelow Creek Trail are failing and have the potential to deliver sediment directly to Streelow Creek. The failing roads and associated drainage structures need improvements to avoid sediment delivery into a salmon spawning stream and to ensure that the bike-hike trail remains available for safe and enjoyable visitor use.

Figure 1. Location of Streelow Creek Trail Improvement Project Area.

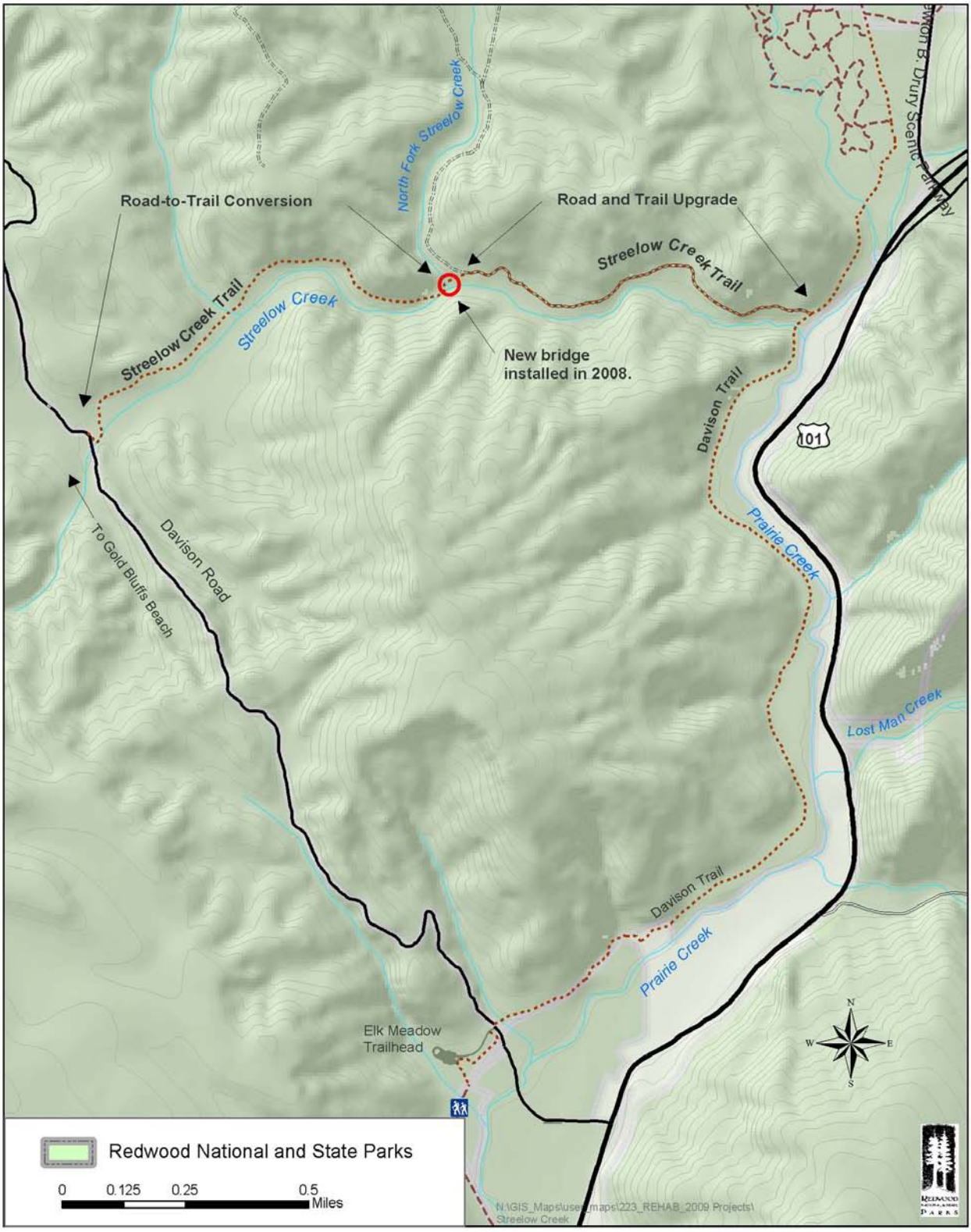

Figure 2. Streelow Creek Trail road-to-trail conversion, and road and trail improvements.

The purpose of the project is treat old, failing logging roads to prevent sediment delivery into Streelow Creek and to improve visitor safety and experience by providing a stable and level trail surface. The project is needed to protect three species of salmonids listed as threatened, to improve the safety and experience for park visitors who use the Streelow Creek Trail, and to ensure continued park administrative access for future watershed restoration projects.

Alternatives, Including the Proposed Action
Two alternatives are analyzed in this environmental assessment, the proposed action and a no action alternative. The proposed action would involve treating the failing surface and drainage on the western portion of the road and convert it to a trail not open to motor vehicles, and upgrading the eastern portion of the road to modern road standards for use by park administrative vehicles and trail users. Under a no action alternative, the road and drainage structures would receive minimal maintenance until they fail and the road becomes impassable. An alternative in which the entire length of road was converted to trail was considered but not carried through full analysis, because the road is needed for future park administrative access to watershed restoration areas.

Alternative 1: No Action–The no action alternative is required under NPS guidelines for compliance with the National Environmental Policy Act (NEPA) and is used to compare existing conditions with the proposed action. No action means either a continuation of existing management practices or "no project." In this case, the no action alternative is the current management action, which includes maintenance of the existing road surface but no improvements to drainage or the road surface.

Under this alternative, the NPS would maintain the existing culverts by periodically removing debris and sediment that accumulates at the culvert inlets, but culverts would not be removed or replaced. There would be no improvements to the road surface or drainage. Holes and slumps in the road and trail surface would be marked as trail hazards to warn trail users and repaired as funding is available.

Alternative 2: Improve Streelow Creek Trail (Proposed Action, Environmentally Preferred Alternative)–The Streelow Creek Trail is a 1.8-mile-long hiking and bicycle trail. The western half of the road currently is serves only as a trail. The eastern section currently serves as both a trail and administrative access road to previously logged areas that are scheduled for restoration under the watershed restoration program. Under the proposed action, the NPS would convert the westerly 0.9-mile of road to a trail (road-to-trail conversion) and upgrade the easterly 0.9-mile of road to modern road standards for administrative use (Figure 2).

Under the proposed action, the 14-foot-wide road west of North Fork Streelow Creek would be converted to a 6-foot-wide trail by excavating road fill from the outer edge of road. Three Humboldt stream crossings would be excavated to their original channel form. Trail bridges would be installed at the deeper crossings and the trail surface would be rocked, as needed, to provide a stable trail surface. Excavated fill would be moved to a stable location where it would be contoured to blend with the surrounding topography. About 7,240 cubic yards of road fill would be excavated from both stream crossings and road segments. Heavy equipment needed for the road-to-trail conversion would access the work area via Davison Road.

East of North Fork Streelow Creek, the 14-foot-wide road would be upgraded to current standards. Culverts at three stream crossings would be replaced and three new culverts would be installed for road surface drainage. Culverts installed in stream crossings would be set to the original, pre-road stream grade and have capacity for 100-year flow events. Surface drainage would be improved by outsloping the road, installing rolling dips (which allow drainage but can be driven across), and eliminating or clearing existing inboard ditches. Rock would be applied to the reshaped surface, as needed, to provide a stable

road and trail surface. About 4,380 cubic yards of road fill would be excavated from stream crossings and road segments. Excavated fill would be moved to a stable location where it would be contoured to blend with the surrounding topography. Heavy equipment needed for this work would access the work area via the northeast end of Davison Trail.

About four acres of small trees and understory brush would be cleared along the western segment of road and stream crossings for the road-to-trail conversion, and about two acres of vegetation would be cleared from the eastern section of road that would be upgraded. Most of the trees removed would be alder and spruce with some Douglas-fir, redwood, and hemlock removed. Trees removed average 8-12 inches diameter at breast height (dbh); the largest trees would be less than 24 inches dbh. Trees cleared from work sites would be used as mulch (e.g., whole logs, chipped, looped and scattered, etc.) or to create structures in freshly excavated streams. Excess trees would be removed from work sites to make room for the earthmoving work. The contractor who clears the trees would be allowed to remove excess trees of all sizes to reduce fuel accumulations and reduce fire hazard, and to offset costs of clearing.

Heavy equipment (excavators, dozers, dump trucks, logging trucks, etc.) work and use of other tools that create noise in excess of ambient noise levels would occur outside of the noise restriction periods to reduce adverse effects on noise sensitive listed bird species. Instream channel excavations would be completed prior to the onset of the rainy season to avoid erosion and runoff of disturbed soils into streams. Instream work generally must be completed before October 15th. If work involves soil excavation adjacent to a stream channel after October 15th, work sites would be "winterized" at the end of each work day to reduce the chance of erosion and runoff in the event of an unexpected storm. Winterizing, seasonal timing, and other best management practices (Appendix A) would be implemented to reduce short-term adverse effects on listed salmonids.

All vehicles and heavy equipment used in this project would be cleaned prior to entering the park to prevent transmission of exotic species; i.e., plants, animals or pathogens (Port Orford cedar root rot, Sudden Oak Death). Removal of all vegetative matter or mud from the undercarriage or tracks of vehicles and equipment is sufficient for this purpose. If vehicles or equipment travel to infected areas in California or Oregon during project implementation, they shall be cleaned before re-entering the park.

Excavated material would be moved to stable locations where it would not erode into the stream, shaped to blend with the surrounding topography, and mulched with vegetation removed for the excavation or other locally obtained mulch to reduce post-excavation erosion of newly disturbed soils. Mulching with local native plant materials encourages natural revegetation and avoids the need for manual replanting.

Work would be conducted over multiple construction seasons to protect endangered species, rather than continuously from start to completion. East of North Fork Streelow Creek, road and trail upgrade work would begin in 2010 after July 10th. Clearing vegetation from work sites and performing earthmoving tasks would occur at the same time and may require two construction seasons to complete. West of North Fork Streelow Creek where the noise restriction periods are longer, the road-to-trail conversion work would begin in 2010 after September 15th. This first season would include the clearing of the construction corridor that would be completed by January 31, 2011. The second season would begin on September 16, 2011 and would include the heavy equipment work to physically convert the road to a narrow trail. The next phase of this project would begin immediately following the heavy equipment work and would continue through March 2012. This phase would include trail finishing work and construction of trail structures, which would be completed prior to February 1, 2012. Thus, the Steelow Creek Trail would be closed from July 2010 through June 2012 because of the short construction seasons and concerns for endangered species. Closures following earthmoving phases are needed to ensure recently disturbed road and trail surfaces dry and harden before use. Information on trail closures related to this project would be

posted at the trailheads and visitor centers and announced through news releases. Wet soil conditions might require longer closures for safety and resource protection.

Environmentally Preferred Alternative
The environmentally preferred alternative is the one that best meets the criteria identified in Section 101 of the National Environmental Policy Act (NEPA) as outlined below.

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.
- Preserve important historic, cultural and natural aspects of our national heritage.
- Enhance the quality of renewable resources.

The NPS has determined that Alternative 2: Improve Streelow Creek Trail (the Proposed Action) is the environmentally preferred alternative. This alternative would reduce the threat of sedimentation to streams, rehabilitate watersheds damaged by logging, and protect three threatened anadromous salmonid species and designated critical habitat for two of these species by

- restoring the original topography of stream channels and banks by removing stream crossings,
- reducing the threat of sediment delivery to streams from unstable road fill, and
- improving water quality by reducing input of fine sediment.

The proposed action would also improve visitor safety and experience by stabilizing the old logging roads that have been used as a hiking and bicycle trail. The existing trail has holes and slumps in the road bed due to poor surface drainage, and stream crossings are failing due to inadequate and worn drainage structures.

The no action alternative is not the environmentally preferred alternative because the potential for stream crossing and road failures would persist. Stream crossings and road segments would continue to erode gradually or fail catastrophically during a large storm. Sediment would continue to be delivered to streams either slowly through gradual erosion or from large-scale slope, culvert, and/or stream crossing failures. The sediment delivered to streams would move downstream and degrade the quality of habitat for threatened salmonid species in Streelow and Prairie Creeks.

Consultation with Other Agencies
Endangered Species—Informal consultation on this project began during an Interagency Consultation Team (ICT) meeting with NPS, the U.S. Fish and Wildlife Service (USFWS), and the U.S. National Oceanic and Atmospheric Administration (NOAA) Fisheries staff on February 10, 2009 to discuss the proposed project and determine whether the project would require informal or formal consultation under the requirements of Section 7 of the Endangered Species Act.

A field review of the project with agency personnel took place on February 19, 2009. Based on discussions of potential impacts of the proposal to listed terrestrial and aquatic species, an informal consultation was conducted with USFWS and a formal consultation was conducted with NOAA Fisheries.

The NPS submitted a final biological assessment to the USFWS on May 21, 2009 that described the project, potential effects of the project on northern spotted owls and marbled murrelets, and measures to minimize adverse effects on these species. The USFWS issued a letter of concurrence file number 8-14-2009-3622-81331-2009-I-0105 dated June 9, 2009 which agreed with the NPS determination that the project may affect but is not likely to adversely affect the threatened bird species.

The NPS submitted a biological assessment to NOAA Fisheries on September 4, 2009 that described the project, potential effects of the project on Southern Oregon/Northern California Coast (SONCC) coho salmon, California Coastal (CC) Chinook salmon, and Northern California (NC) steelhead trout; and measures to avoid or minimize adverse effects on these species, and designated critical habitat for two of these species. Mitigation measures associated with the species and their habitat would also serve to protect Essential Fish Habitat. NOAA Fisheries issued a Biological Opinion dated February 8, 2010 that determined the project is not likely to jeopardize the continued existence of SONCC coho salmon, CC Chinook salmon, or NC steelhead; and is not likely to result in the destruction or adverse modification of designated critical habitat for SONCC coho salmon or NC steelhead. NOAA Fisheries determined that effects to salmonids would primarily occur by electroshocking, dewatering, harassment, and increased turbidity during placement of temporary stream diversions. Young-of-the-year coho and Chinook salmon, and steelhead are most susceptible to potential injury or death from placement of the diversions. An incidental take statement was included with the opinion that includes required measures and terms and conditions that are expected to reduce incidental take of these species as a result of the proposed action.

The NPS prepared biological assessments and completed consultations with NOAA Fisheries for potential effects to listed fish species throughout the park from annual and periodic road maintenance (NOAA Fisheries' biological opinion and letter of concurrence 151422SWR02AR6347, March 2003, updated August 4, 2008, file number 151422SWR2005AR00575). The NPS requested incidental take for California Coastal Chinook salmon, Southern Oregon/Northern California Coasts coho salmon, and Northern California steelhead under the NPS biological assessment first prepared in 2003 for the Annual and Periodic Road Maintenance program, and the 2006 addendum. NMFS authorized an unquantified amount of take based on miles of stream affected under the 2008 BO and letter of concurrence, file number 151422SWR2005AR00575 dated August 4, 2008.

Cultural Resource Consultations—NPS staff attended the Yurok Tribe's Culture Committee meeting on February 27, 2009 to present the project to the committee members. The committee had no specific comments.

The National Historic Preservation Act of 1966 requires federal agencies to consult with the state historic preservation officer (SHPO) if an undertaking would have the potential to affect properties listed or eligible for listing on the National Register of Historic Places.

The NPS notified the SHPO and Yurok Tribal Heritage Preservation Officer (YTHPO) in correspondence dated June 11, 2009 that an environmental assessment was being prepared and that preparation of the EA would be used to comply with Section 106 of the National Historic Preservation Act. In accordance with section 800.8 of the Advisory Council on Historic Preservation's regulations (36 CFR Part 800), the letter notified the SHPO and YTHPO in advance of the NPS intention to use the EA to meet its obligations under Section 106.

The EA will be submitted to the SHPO and Yurok THPO seeking concurrence from the California SHPO that NPS had taken sufficient measures to identify resources eligible for or listed on the National Register of Historic Places within the project area of potential effect and that no historic properties are expected to be affected by the proposed project.

Compliance with Floodplains and Wetlands Executive Orders

The NPS carries out its responsibilities to manage floodplains and wetlands in compliance with Executive Orders 11988 "Floodplain Management" and 11990 "Protection of Wetlands" under procedures described in Director's Orders #77-1 Wetland Protection and #77-2 Floodplain Management and their associated implementation manuals. A Statement of Findings (SOF) for effects to Floodplains and Wetlands will

not be prepared for this project. Actions designed specifically for the purpose of restoring degraded natural wetland, stream, riparian, or other aquatic habitats or ecological processes are exempt from the NPS requirement to prepare a wetland SOF. Actions located in floodplains that involve little physical development and do not involve overnight occupation, including foot trails in non-high hazard areas, are exempt from the NPS requirement to prepare a floodplain SOF. The proposed action would remove old structures that degrade the natural floodplain and wetland values associated with Streelow Creek and its tributaries, and help restore natural floodplain and wetlands functions and values.

Removal of Woody Biomass
In 2005, the Department of the Interior published a final rule (48 CFR Parts 1437 and 1452) under the authority found in the NPS Organic Act (16 USC 1) outlining procedures to allow service contractors the option to remove woody biomass by-products generated as a result of Department land management activities whenever ecologically appropriate. Ecological benefits of removing woody biomass include reduced threat of wildfire, and improved forest health, wildlife habitat, and watershed protection.

Public Involvement
This project is very similar to projects completed in 2008 in the Streelow Creek watershed (Figure 2) and 2009 in North Fork Lost Man Creek (Figure 3) that replaced culverted stream crossings with bridges to reduce sedimentation, improve fish passage, and provide for a safe and enjoyable visitor experience. No public comments were received on the 2007 Streelow Creek EA (NPS 2007) or the 2009 North Fork Lost Man Creek EA (NPS 2009a). This type of project to restore salmonid habitat is common throughout the range of salmonids in the local area and the north coast region and is supported by agencies, stakeholders, and the general public. The proposed project is also similar to the much more extensive watershed restoration project in the Lost Man Creek watershed near the Streelow Creek project area. Public comment received on the watershed restoration program described in the 1999 GMP/FEIS and the 2006 environmental assessment for the Lost Man Creek restoration project indicates broad public support for such projects. Therefore, no scoping was conducted for this specific project. The impact topics addressed in this EA are the same as those addressed in the earlier Streelow Creek bridge (NPS 2007), North Fork Lost Man Creek bridge (NPS 2009a), and Lost Man Creek watershed restoration (2006f) environmental assessments.

Affected Environment
Setting and Access—The Streelow Creek Trail is located on old logging roads acquired when the park was created in 1968. The Arcata Redwood Company constructed the roads in the early 1960s to move logs from harvest areas to the mill previously located on the south side of Davison Road. The roads connected to a major haul road that ran along Prairie Creek. Davison Road runs west from U.S. Highway 101 about three miles north of Orick. It leads to Gold Bluffs Beach Road which provides coastal access to Fern Canyon, one of the most visited attractions in Prairie Creek Redwoods State Park (Figure 3).

In 1999, the NPS developed the Elk Meadow Trailhead on the site of the former Arcata Redwood Company mill and converted the haul road along Prairie Creek to the Davison Trail (Figure 3). The Davison Trail is a hiking and bicycle trail between Prairie Creek Redwoods State Park and the Elk Meadow Trailhead.

As part of the trail development project, the Streelow Creek Trail was established as a hiking and bicycle trail to connect the Davison Trail to Davison Road and the Coastal Trail. These trails form a loop with other trails and portions of the Newton B. Drury Scenic Parkway, a low-speed paved road through old-growth redwood forest at Prairie Creek Redwoods State Park.

Climate and Air Quality—The project area has a mild climate due to its low elevation and proximity to the Pacific Ocean. The average temperature range reported at Prairie Creek Redwoods State Park during

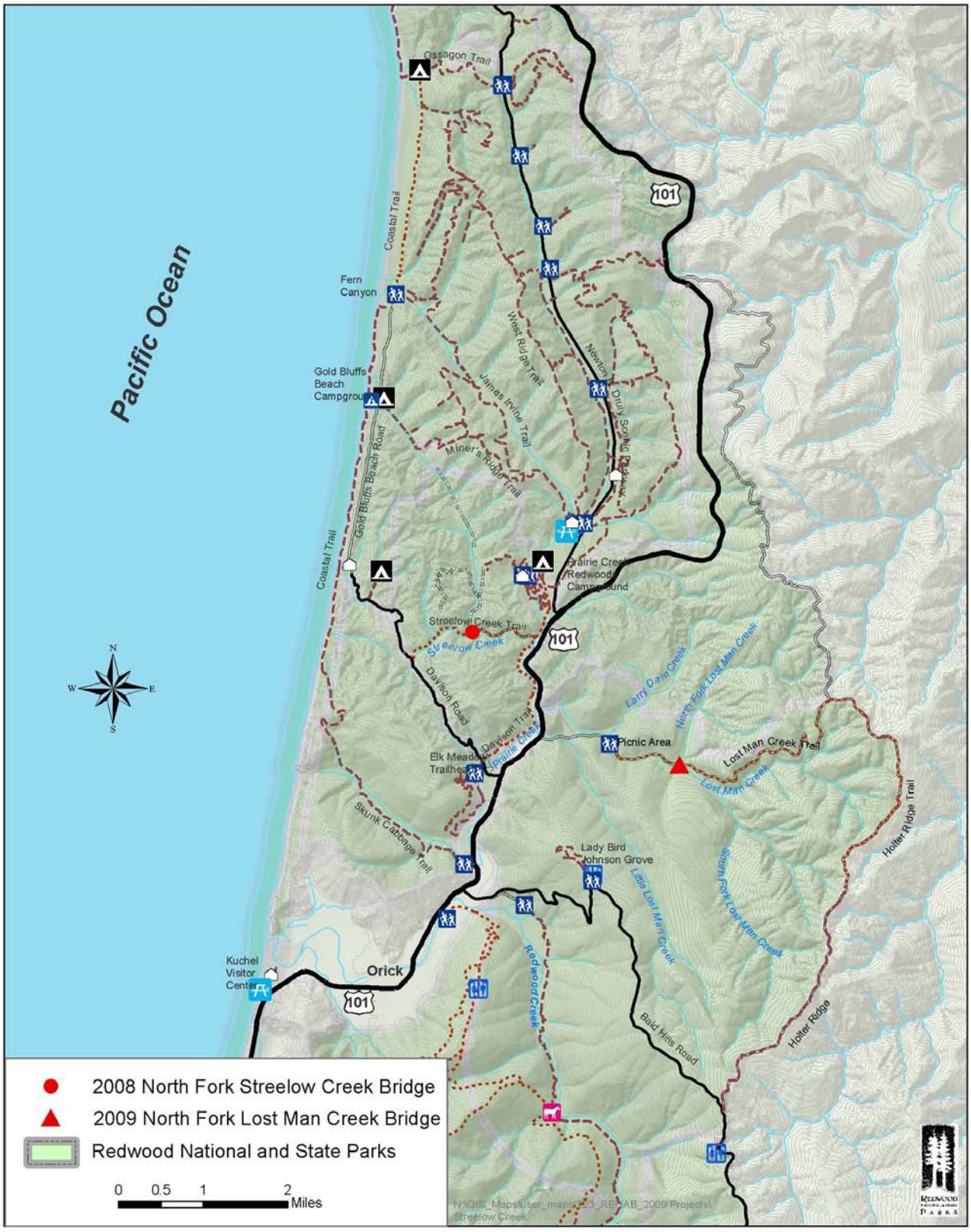

Figure 3. Trails, facilities and recent fish passage projects in the southern part of Redwood National and State Parks.

winter is 35-55°F and 40-75 °F in summer. Mean daytime temperatures at Prairie Creek Redwoods State Park are 47 °F in January and 59 °F in June. Most precipitation falls as rain between November and April. Average annual rainfall in the project area is about 60 inches. Snow is rare. High winds occur in the Prairie Creek valley during major winter storms. Sustained wind speeds exceeding 35 miles per hour generally cause trees and branches to fall, and result in road and trail closures throughout the park.

Air quality in the project area is excellent due to lack of major pollution sources from the direction of the prevailing northwest winds across the Pacific Ocean. Primary pollution sources are vehicle emissions from roads and highways, dust created by vehicles driving on dirt roads, smoke from woodstoves during cold months, prescribed fires in the region, and wildfires. Only wildfires and prescribed fires have the potential to reduce air quality below state or federal air quality standards.

Topography, Geology, and Soils—Streelow Creek drains the east side of Gold Bluffs, the first ridge of the Coast Range along the Pacific Ocean. The ridgetop lies at about 640 feet above sea level. Streelow Creek meets Prairie Creek at an elevation of 60 feet above sea level. The project area lies in the lower hillslope position of Streelow Creek where hillslope steepness varies from nearly flat to more than 50 percent. Hillslope steepness averages about 40 percent with isolated steeper slopes along the mainstem of Streelow Creek.

The project area is underlain by the Prairie Creek and Franciscan formations. The Prairie Creek Formation is comprised of Neogene-period (Pleistocene-Pliocene) materials that are weakly consolidated due to the low amounts of clay and high amounts of sand, gravel, cobbles, and silts thought to have been deposited in a river delta by the Klamath River more than two million years ago. While these materials are relatively stable from a landslide perspective, they are prone to surface erosion because of their small particle size and weak consolidation.

The Franciscan Formation is comprised of Mesozoic-period (Cretaceous to Jurassic) rocks laid down on the ocean floor as deposits of sand and mud about 150 to 100 million years ago. The Franciscan Formation underlies most of the park. These deposits were carried eastward on the oceanic plate, accreted to the North American continent, and eventually uplifted to form the Coast Range. Through time, folding and faulting further complicated the Franciscan complex rocks. Bedrock beneath the park is mostly composed of sedimentary graywacke sandstone, mudstone, metamorphic schist, and minor amounts of conglomerates and mélange. Deep rotational landslides and debris slides are erosional processes common to this geologic unit.

Hydrology and Water Quality—Streelow Creek is a relatively small watershed that drains a total area of about four square miles and is about three miles long. Steelow Creek is a tributary of Prairie Creek, which is the largest tributary of Redwood Creek with a drainage area of about 41 square miles. North Fork Streelow Creek is the only major branch in the watershed and is about two miles long. Streamflow in Streelow Creek ranges from two cubic feet per second (cfs) during low flow periods to an estimated 400 cfs in a 100-year flow event. The 100-year flow event on Prairie Creek at Davison Road, about 3 miles downstream of the project area, is estimated to be 16,200 cfs.

Temperature and turbidity are two common indicators of water quality in park streams. There are essentially no other point-source or non-point-source pollutants (pesticides, fertilizers, bacteria) that affect park streams, which are mostly upstream of residential and agricultural areas. Petrochemical runoff from roads and highways do not cause major pollution problems. Water quality in Prairie Creek at the confluence with Streelow Creek is very good, especially in comparison to other park streams that have been affected by logging. Most of the Prairie Creek watershed upstream of Streelow Creek is unlogged. Water quality in Streelow Creek is assumed to have improved since harvest activities ceased in 1968,

because soils have stabilized and vegetation (particularly streamside overstory trees that provide shade to cool streams) has reestablished.

Floodplains and Wetlands—The narrow floodplain of Streelow Creek generally extends from its confluence with Prairie Creek, upstream to North Fork Steelow Creek. Prior to the major floods, logging, and road construction in the early 1960s, the Streelow Creek floodplain was probably less pronounced than today. The combined effect of large floods and poorly regulated forest practices caused widespread erosion that filled Streelow Creek's mainstem channel and produced a wider floodplain. The Streelow Creek Trail is generally above and outside of the Streelow Creek floodplain, with the possible exception of the trail bridge that crosses the North Fork. The short trail segments approaching the bridge would likely be inundated by storms exceeding a 25-year flow event.

Wetlands in the project area consist of riparian areas that line both Streelow and Prairie Creeks. The riparian zone is most extensive at the confluence of the creeks and the downstream reaches. The narrow Streelow Creek watershed is well drained because of its steepness which precludes the development of extensive wetlands. Red alder and skunk cabbage in the riparian zones are the primary obligate wetland plants in the project area.

Vegetation— The original forest included coast redwood, Douglas-fir, and Sitka spruce as the dominant tree species. The entire Streelow Creek watershed was logged between 1954 and 1964. The Prairie Creek corridor in the project area was also logged, but a few individual old-growth redwood trees remain along what is now the trail.

Following clearcut logging, the forest regrew without further management to replant and/or thin the second-growth forest. The project area exhibits some multi-layered canopy development, with understory vegetation and higher plant species diversity than other unmanaged second-growth redwood forests in the park.

The vegetation away from the streams is a dense stand of second-growth redwood, Douglas-fir, and Sitka spruce. The largest redwoods are about 24-30 inches dbh. Red alder has established in riparian areas along streams. The understory vegetation consists of huckleberry, salal, ferns, and other species typically found in second-growth forests in previous clearcuts. The most common invasive exotic plants along the Streelow Creek Trail are foxglove and Himalaya berry, with some pampas grass in areas with sufficient sunlight. These invasive species are unlikely to thrive because the project area is too overgrown and shady for these non-native plants.

Fish and Wildlife—The three federally-listed species of fish that occupy Streelow Creek are described below under *Sensitive, Threatened and Endangered Species*. Other fish identified or reported in Streelow Creek include resident rainbow trout (*Oncorhynchus mykiss*), prickly sculpin (*Cottus asper*), coast range sculpin (*Cottus aleuticus*), riffle sculpin (*Cottus gulosus* Girard), threespine stickleback (*Gasterosteus aculeatus*), and Pacific lamprey (*Lampetra tridentata*).

The project area is inhabited by amphibians, reptiles, birds, and mammals typically found in well-established second-growth redwood forest and riparian areas in the park. Coastal giant salamander larvae (*Dicamptodon tenebrosus*) have been observed in Streelow Creek and probably occur throughout perennial streams in the watershed. Adult coastal giant salamanders have been observed on roads or under logs and bark. The project area is also inhabited by northern red-legged frogs (*Rana aurora)* and tailed frogs (*Ascaphus truei*). Larger mammals that have been seen in the vicinity of the project area include black bears, cougars, bobcats, Roosevelt elk, and black-tailed deer.

Sensitive, Threatened and Endangered Species—Botanical surveys of the project area were conducted under previous contracts issued by California Department of Fish and Game in 2007 as part of the Streelow Creek bridge project. No rare or sensitive plants were discovered in the project area.

Four species of anadromous salmon and trout occupy the streams in the project area. Anadromous fish spend most of their life cycle in the ocean and return to freshwater to spawn. Anadromous salmonids identified in Streelow Creek include coastal cutthroat trout (*O. clarki*), NC steelhead (*Oncorhynchus mykiss*), SONCC coho salmon (*O. kisutch*), and CC Chinook salmon (*O. tshawytscha*). Most spawning and rearing occurs in the mainstem of Streelow Creek and North Fork Streelow Creek.

Coho salmon are also listed as threatened by the State of California.

Stream reaches of Streelow Creek accessible to SONCC coho salmon and NC steelhead are designated critical habitat. Critical habitat consists of the water, substrate and adjacent riparian zones. Accessible reaches are those within their historical range that can be occupied by any life stage of salmon.

Coastal cutthroat trout are native to northwestern California, inhabiting most coastal streams north of the Eel River. This species is not currently listed or proposed, or a candidate species for listing, as threatened or endangered. RNSP fisheries staff suspect that a few resident, non-migratory populations of cutthroat trout inhabit Streelow Creek.

No designated critical habitat for northern spotted owls or marbled murrelets occurs in the project area. The entire project area is within suitable, unsurveyed spotted owl and Pacific fisher habitat and is assumed occupied. The eastern portion of the project area is suitable foraging spotted owl habitat only, while the western portion is suitable nesting, roosting, and foraging habitat. No suitable marbled murrelet habitat exists in the eastern portion of the project area but the western portion of the project area has a handful of residual old growth redwood trees and there is a sparse residual stand of old growth on the opposite bank of Streelow Creek that contains suitable murrelet nesting trees

Cultural Resources—Redwood National Park contains a significant set of cultural resources including archeological sites, historic structures, cultural landscapes, ethnographic properties and objects.

Archeological Resources—Archeological sites, the majority of which are prehistoric, are recorded throughout the park, along the coast, inland and especially in the Bald Hills of the Redwood Creek basin. These sites range from temporary and seasonal camps to trail use sites to villages and sacred places, representing a 4,500-year continuous record of habitation extending until after Euroamerican contact at about 1850 by at least three different Native American groups and their ancestors. Fish, game, and acorns were particularly significant foods for the local Native Americans. In addition to villages of wooden plank houses and sweathouses, there were also numerous temporary summer camps and specialized use areas throughout the region. An extensive trade and travel network also existed. Today, the Tolowa, the Yurok, and the Hupa have ancestral ties to the park. At the time of contact with Euroamericans, the Yurok lived along the coast and the Chilula along Redwood Creek. The Chilula, whose territory included parklands in the Redwood Creek basin, were almost decimated after contact; most of those who remained were assimilated by the Hupa to the east of the park.

The Streelow Creek project area lies within the ancestral lands of the Yurok people. No prehistoric archeological sites are known within the project area.

Historic archeological resources in the park consist of remains of Euroamerican settlement and activities from the late 1800s. Evidence of historic settlements, ranching, logging, mining, and recreation are all types of resources that can be found. Logging was the primary historic activity that occurred in the

Prairie Creek watershed. No historic archeological sites are known within the project area. However a log stringer bridge was recorded and documented and is described below in the Historic Resources Section.

Ethnographic Properties—The project area contains plant resources traditionally important to the Yurok including alder, hazel, huckleberry, iris, maidenhair fern, redwood, salmonberry, sword fern, thimbleberry, wild ginger, and *Woodwardia* fern. No national register-eligible gathering areas or specific resources were identified.

Historic Resources—The following historic resources summary was derived from Burns (2006). Most of the northern part of the state of California was not populated by Euroamerican settlers as early or as quickly as other parts of the state south of San Francisco. The densely timbered tracts of land bordering the bay and extending like a "great belt" into the interior were a hindrance to early settlement by Euro-Americans. With the exception of a Russian colony at Fort Ross (Sonoma County, 200 hundred miles south of the park) established in 1812, exploration and occupancy of the densely forested northern California did not begin on a major scale until gold was discovered there in the early 1850s. The Union Gold Bluffs mine was established at Major Creek in what is now RNSP after gold was discovered there in 1850.

The dense forests of northern California provided the timber needed by the rush of settlers arriving to stake out a claim. Mills sprang up and large-scale logging was soon underway resulting in the diminishing of the once immense stands of coastal redwood forest by the end of the 1800s.

Initially the only way of transporting lumber was by custom-built schooners adept at carrying lumber through the steep and rocky coastal terrain of the west coast. Transportation became less difficult with the organization of the San Francisco and North Pacific Railroad Company in 1869. The railroad became the fastest way to transport logs to mills and timber harvesting rapidly became the largest industry in this region. In the absence of motorized heavy equipment, land was cleared to construct railroads and highways through the redwood forest by blasting with explosives, which was also an efficient means of clearing stumps, grading and excavating through rock masses. By the mid 1890s, the northwest lumber industry had been infused with new industrial machinery that exponentially increased production and drove down market prices. The capitalization of the lumber industry caused smaller, local-run mills to be consumed by larger corporations as early as 1910.

The demand for lumber across the United States was leading to the rapid depletion of the ancient forests. Preservation of the dwindling redwood forests along the coast and the giant sequoias in the Sierra Nevada became a concern as early as the 1860s. Save-the-Redwoods League, founded in 1918, succeeded in preserving intact stands of North Coast redwood groves that became the nuclei of Jedediah Smith Redwoods State Park, Del Norte Coast Redwoods State Park, and Prairie Creek Redwoods State Park. Logging continued in the redwoods most of which had become privately owned by the 1890s. With the onset of WWII, the subsequent economic boom of the 1950s and the use of gasoline powered chain saws and heavy trucks and bulldozers, logging peaked so that by the 1960s nearly 90 percent of the original redwood forests had been logged. In 1968, Redwood National Park was established to secure some of the last unlogged stands of north coast redwoods. In 1978, the national park was expanded; the majority of the expansion lands had already been logged. The project area was part of the 1968 park.

For the purposes of 36 CFR 800 the implementing regulations of Section 106 of the National Historic Preservation Act, the Area of Potential Effect for the proposed project can be defined as follows:

- 0.9-linear mile of the existing Streelow Creek Trail that is to be converted to trail and that also includes a buffer that is 125 feet on both sides of the existing road edges or the maximum width

of expected disturbance whichever is greater. Disturbance is expected in fill to a maximum depth of approximately 10 feet or to natural slope grade.

- 0.9-linear mile of the existing Streelow Creek Trail that is slated for upgrade treatments only and that includes a buffer of 25 feet on both sides of the existing road edges or the maximum width of expected disturbance whichever is greater. Disturbance is expected in fill to a maximum depth of approximately 10 feet or to natural slope grade.
- Thirteen locations where culverts or Humboldt crossings will be removed and/or replaced. These areas include the culvert location and an area no less than 100 square feet around each culvert's entry point and exit point. Disturbance is expected to a maximum depth of approximately 10 feet or to natural channel grade.
- Staging areas and access points. Disturbance to staging areas and access points would be limited to the surface area of no more than 2-3 inches in depth.

Ground disturbance related to the project has the potential to adversely affect any intact archeological deposits that may exist in the project area. In addition noise, traffic, ground disturbance and use of the trail have the potential to disturb or make inaccessible resources of ethnographic significance to Yurok people and that may be eligible for listing on the National Register of Historic Places. For a map of the area of potential effect see Sloan (2009).

For the purposes of identifying if historic properties are located within the Area of Potential Effect for the proposed action, NPS entered into a task agreement with the Yurok Tribe to conduct background research, literature review, and field inventories. The final report was submitted to NPS in December 2009. Results of these efforts include maps depicting the area of potential effect, and indicate that no archeological resources, historic structures, resources of ethnographic significance, cultural landscapes, or any historic properties are located within the area of potential effect for the proposed action (Sloan 2009). Streelow Road was constructed in the 1960s. It is therefore not eligible for listing on the National Register of Historic Places since it is not older than 50 years in age.

Although two 1940s vehicles were found adjacent to each other and within the APE for the proposed action, these were found to be so deteriorated as to lack any vehicle identification marks. They lack sufficient in integrity to be eligible for listing on the National Register of Historic Places (Sloan 2009). A California Department of Parks and Recreation Primary Record Form DPR 523 was prepared for this isolated find (Sloan 2009).

Visitor Use and Experience—Streelow Creek Trail is a 1.8-mile-long hiking and bicycle trail that connects the Davison Trail to Davison Road. Davison Road is a narrow, winding, gravel road that runs about four miles from U.S. Highway 101 to Gold Bluffs Beach; it is closed to trailers. Gold Bluffs Beach Road is a gravel road that runs about four miles along the base of the ocean bluffs to Fern Canyon, a popular visitor attraction in the area (Figure 3).

Streelow Creek Trail is an integral part of trail loops in the southern area of the park. Streelow Creek Trail connects to Davison Road which connects to Gold Bluffs Beach Road and the Coastal Trail. From there it is possible to reach any of the other trails that connect the Coastal Trail with the Newton B. Drury Scenic Parkway. Davison Trail connects to the south end of the parkway and back to Streelow Creek Trail, completing a loop. Trail access is provided at the Elk Meadow Trailhead, south of Davison Road, at the Elk Prairie Visitor Center in Prairie Creek Redwoods State Park, and along the parkway.

Environmental Consequences

This section describes the anticipated affects of the alternatives on natural and cultural resources, and park operations and visitors, and is followed by a discussion of the NPS legal and policy requirements for non-impairment of park resources and values.

Methodology for Assessing Impacts—Impacts to resources were assessed using several methods, including best professional judgment and knowledge of the effects of similar actions undertaken by the NPS in Redwood National Park and other NPS units. Impacts to vegetation, wildlife, threatened and endangered species, and cultural resources were assessed through site visits and discussions among NPS botanists, biologists, and archeologist. Impacts on threatened and endangered species were assessed in consultation with USFWS and NOAA Fisheries and review of the letter of concurrence and biological opinion issued by these agencies. Impacts on water quality, hydrology and geomorphology were determined through inspection of the project area and on-site analyses by NPS geologists.

Effects on Air Quality—Under the no action alternative, there would be no effects on air quality from periodic removal of debris to clear blocked culverts and repair failed road segments. Under the proposed action, there would be temporary localized decreases in air quality from heavy equipment emissions while working at the site and from dust during excavation. These effects would be adverse, localized, temporary, and negligible.

Cumulative Effects on Air Quality—Cumulative effects on air quality in the park result from dust from soil disturbance and emissions from vehicles and power tools associated with maintenance of park roads and trails, second-growth management, fire management including preparation of roads and fire lines and smoke from prescribed fires and wildfires, timber harvest on adjacent lands, vehicle emissions from public roads and highways, and smoke from wood stoves in adjacent communities. Adverse effects from smoke from prescribed fires and wildfires would have the greatest potential for moderate adverse effects but smoke is temporary for the duration of the fire. These effects are adverse, localized to widespread, temporary but repeated, and negligible to moderate. No long-term cumulative adverse effects on air quality or air quality related values in the park are anticipated for the foreseeable future because the regional prevailing winds are from the northwest across the Pacific Ocean where there are no sources of air pollution. The cumulative effects on air quality under either alternative would be negligible, because the primary sources of air pollution in the project area are vehicle emissions on highways and smoke from fires, and state air quality standards in the project area are rarely violated by either source.

Effects on Soils and Topography—All soils in the project area were previously disturbed by logging and associated road construction. Under the no action alternative, there would be no changes to topography of the project area, which was altered by previous road building associated with logging. The no action alternative would not have any new project-related construction effects on soils in the project area. The road fill in stream crossings and associated road segments would continue to gradually erode during storms. The erosion rate would increase as the culverts, stream crossings, and road fill degrade. Eventually, culverts and stream crossings would fail completely, causing erosion of an estimated 2,670 cubic yards of road fill that would be delivered to Streelow Creek.

Catastrophic failure of stream crossings and adjacent road segments could also lead to stream bank failures as the stream channels adjust to a rapid influx of sediment. Bank failures commonly initiate slope failures in confined stream reaches such as those found along portions of Streelow Creek.

Gradual erosion of stream crossings under the no action alternative would be a long-term adverse effect on soils adjacent to the road corridor. This adverse effect would range from negligible in years of low rainfall to moderate in wet years or intense storms. Catastrophic or eventual complete failure of the stream crossings would be a moderate to severe adverse effect on soils in the project area and could result in moderate adverse effects to local topography if slope failures result.

Under the proposed action, about six acres of soils would be excavated or disturbed for the road-to-trail conversion and road upgrade work. These soils were previously disturbed during original road construction and timber harvest.

Under the proposed action, a total of 11,620 cubic yards of soil (road fill) would be excavated. About 7,240 cubic yards would be excavated for the road-to-trail conversion, and about 4,380 cubic yards to upgrade the eastern section of road. Road-to-trail conversion would reduce the 14-foot-wide road to a 6-foot-wide trail. The road upgrade portion of the project would replace three existing culverts at stream crossings and install three new ditch relief culverts for improved road surface drainage. Improved surface drainage would also be provided by outsloping the surface of the road in selected areas and constructing rolling dips. All soil to be excavated is road fill that would be moved to stable locations as close as possible to the work site and where it would not erode into streams. Newly excavated soil would be shaped and blended with surrounding topography, and mulched with vegetation removed from excavation areas. All actions to improve surface drainage would protect soils from erosion. The benefit would be long-term and localized, and moderate within the project area where soils are protected.

The effects on soils and topography from excavation of 11,620 cubic yards of unstable road fill that would be moved to stable locations and mulched to prevent erosion are judged to be long-term, beneficial and minor from restoration of topography in the Streelow Creek, and long-term, beneficial and moderate for reduction of sediment threat to Streelow Creek and Prairie Creek from failing stream crossings and road segments. The benefit to Streelow Creek would be greater than the benefit to Prairie Creek, because Streelow Creek is within the sediment source area, and Prairie Creek has a greater capacity to transport sediment out of the area.

Cumulative Effects on Soils and Topography—Under the proposed action, the road-to-trail conversion and road upgrade would have no direct effect on topography and soils in other tributaries in the Redwood Creek watershed. Topography in the other tributaries of Redwood Creek would remain altered by presence of logging roads. Soils would continue to erode in unstable areas along untreated roads in the rest of the watershed. Landslides related to untreated roads would occasionally alter topography, particularly during major storms.

Around 1,400 miles of forest roads and over 5,000 miles of skid trails are estimated to have been built within the Redwood Creek watershed. About 445 miles of roads and 3,000 miles of skid trails were included within the national park boundaries. Removal and upgrade of a few miles of logging road under the proposed action would have negligible short-term or long-term benefits to the watershed as a whole, and minor benefits to soils and topography in the project area over the long-term. There would be negligible benefits to the mainstem of Redwood Creek and Redwood Creek estuary and minor benefits to Prairie Creek from the proposed action. Over the very long-term, if failing roads within the park are removed and if roads upstream and outside the park are maintained and effective erosion control implemented prior to major storms, there would be a major benefit to soils and topography in the Redwood Creek watershed from preventing unnaturally high rates of erosion. The long-term benefit to the Redwood Creek estuary from reducing the influx of sediment would be a moderate benefit to estuary function because the Redwood Creek levees would continue to alter the hydrology and function of the estuary.

Effects on Water Quality, Hydrology and the Adjacent Watershed—Under the no action alternative, there would be no construction-related effects on water quality from excavation to remove the culverts or the stream crossings. The culverts and stream crossings would continue to degrade as the drainage structures age and deteriorate. Gradual failure would release small quantities of sediment into the streams during storms. Major storms would cause more sediment to enter the streams. Eventually, the culverts and stream crossings would fail completely, which would most likely occur during a major storm. Complete

failure would deliver an estimated 1,300 cubic yards of sediment directly to Streelow Creek. The eroded material would in turn be delivered to Prairie Creek located varying distances downstream. Gradual delivery of small volumes of sediment into the streams would have a long-term adverse effect on water quality from increased turbidity and sedimentation. This chronic turbidity would be a long-term minor adverse effect most noticeable during storms. Complete failure of the stream crossings would have a moderate to significant adverse effect on water quality in Streelow Creek and a moderate adverse effect in Prairie Creek that could persist for decades, based on effects on other park streams where stream crossings and roads have failed catastrophically.

Under the proposed action, there would be short-term adverse effects on water quality from surface erosion of sediment from excavation of 3,645 cubic yards to remove and/or replace culverts. Erosion would be reduced by working during low flow periods in September, using silt fences and other standard best management practices for erosion control, mulching of newly exposed soils, and by completing the project prior to the onset of the rainy season. Mitigation measures to minimize degradation of water quality would reduce the short-term effects on water quality from increased sediment in the stream and higher turbidity to minor.

There would be long-term beneficial effects to water quality and hydrology from removal and/or reconstruction of failing crossings and undersized drainage structures. At crossings to be removed, stream channels would be restored to their original pre-road configuration. At crossings to be upgraded, new culverts would be installed on original stream grade and culverts would have the capacity to carry a 100-year flow event. The benefit is judged to be minor to moderate, depending on the intensity and duration of rainfall events. In the event of minor flooding (10-year flow events or less), the benefit from removal and upgrade of the stream crossings would most likely be minor. In large flood events (25-year flow events) or intense rainfall over a period of weeks, there would be moderate benefit from crossing removal and road upgrade.

The foot bridges that would replace the culverts on the Streelow Creek Trail would completely span the active channel and would not constrict streamflow. These actions would have a moderate long-term benefit to Streelow Creek hydrology.

The proposed action would have temporary adverse effects on water quality from erosion of newly excavated soils, primarily in the first rainy season as small quantities of sediment are flushed from the work sites. This adverse effect on water quality would be minor for Streelow Creek and negligible for Prairie Creek. There would be an immediate benefit to Streelow Creek hydrology from removal of undersized drainage structures and restoration of the channel morphology where crossings are removed. This benefit would be minor to moderate. The benefit to the hydrology of Prairie Creek would be indirect, long-term, and minor.

Cumulative Effects on Hydrology and Water Quality—The overall cumulative effects on hydrology and water quality in the park relate to past logging and road building, both within what is now the national park and upstream of current park boundaries in the Redwood Creek watershed.

The effect of stream crossing removal and associated minor watershed restoration would be a benefit to the water quality of Prairie Creek and Redwood Creek but the benefit would be negligible because of the adverse effects of remaining abandoned roads and numerous unrestored stream crossings in the Redwood Creek watershed. The removal and upgrade of stream crossings along Streelow Creek would not improve hydrological conditions or water quality in Redwood Creek upstream of its confluence with Prairie Creek.

Damage to forest resources and fish in the Redwood Creek watershed coincided with both intensive timber harvest and a series of large storms between 1955 and 1983 that were accompanied by widespread

flooding and erosion. Land use practices common at the time significantly increased erosion above naturally high levels associated with storms. The large number of improperly designed and maintained roads, landings, and skid trails in the Redwood Creek watershed increased surface erosion and fine sediment production and delivery, and increased the potential for stream diversions, rill and gully erosion, and road related landslides with corresponding increase in sediment production and delivery. Unregulated timber harvest in what is now the park and outside the park on unstable slopes prior to the enactment of the California Forest Practice Rules and removal of riparian vegetation contributed to increased erosion and sediment production. These factors led to the designation of Redwood Creek as sediment impaired by the U.S. Environmental Protection Agency (EPA) under section 303(d) of the Clean Water Act in 1992 (EPA 1998) and temperature impaired in 2002 (SWRCB 2003).

Key changes in Redwood Creek mainstem channel structure over the past 40 years include increases in the volume of stored sediment; decreases in pool numbers and depth; increases in stream width and decreases in stream depth; reduced recruitment of large woody debris; deposition of high levels of fine sediments on the stream bottom; and reduced volumes of large woody debris.

NPS researchers estimate that approximately 55 percent of 1,400 miles of roads in the watershed are not maintained and are therefore more likely to fail during storms than maintained roads. There are several thousand crossings associated with these roads and it is likely that hundreds if not thousands of crossings continue to have diversion potential.

Long-term improvement to the mainstem of Redwood Creek from reducing sediment associated with stream crossings in Streelow Creek would be negligible because of the small amount of sediment removed under the proposed action compared to the potential erosion volume remaining in the Redwood Creek watershed. A major storm would cause erosion in unrestored areas of Redwood Creek and the contribution of Streelow Creek to improved conditions in Redwood Creek would be negligible in comparison to the magnitude of adverse effects basin-wide.

Effects on Floodplains and Wetlands—Under the no action alternative, the floodplain of Streelow Creek would likely continue to be altered by road failures associated with the Streelow Creek Trail. A combined failure of stream crossings and road segments would deliver about 2,670 cubic yards to Steelow Creek and eventually Prairie Creek. In Steelow Creek, the already aggraded reach would aggrade more, possibly initiating streamside landslide erosion. In Prairie Creek, a large rapid influx of sediment could temporarily fill the channel and cause floodwaters to erode the streambanks and floodplain and undermine riparian wetland vegetation, including maples and red alder. Delivery of sediment to the Prairie Creek floodplain following catastrophic failure of stream crossings and road segments in Streelow Creek would be a long-term adverse effect that would vary from minor to severe, depending on the intensity of the storm, the volume of sediment eroded from the roads, and the timing and volume of the flood flows. A storm of sufficient intensity to cause catastrophic failure of old roads in Streelow Creek could cause similar effects on other tributaries of Prairie Creek, which would cause severe damage to the floodplain through scour and aggradation of the stream channel and loss of riparian vegetation.

Under the proposed action, there would be temporary adverse effects to the riparian wetlands adjacent to stream crossing excavations from removal of about 1.2 acres of riparian vegetation, primarily red alders and spruce with minor components of young second-growth redwoods, Douglas-firs and understory plants. This adverse effect would be negligible because the riparian vegetation would recover in a few growing seasons, and all the riparian vegetation that would be disturbed is regrowth following the original disturbance from road construction and logging. There would be an immediate benefit to the floodplain of Streelow Creek at its confluence with Prairie Creek and a long-term benefit to riparian wetlands along Streelow Creek from removal and upgrade of undersized drainage structures and stabilization of the old road bed. This benefit would be negligible in the short-term but minor to moderate in the long-term from

prevention of future catastrophic failure of roads that could bury riparian areas, fill channels, and broaden the floodplains.

Cumulative Effects on Floodplains and Riparian Wetlands—Restoration within the project area would have negligible short-term adverse effects and minor long-term benefits to the floodplain of Prairie Creek. As watershed restoration projects are completed within and outside the park, and new logging roads upstream of the park are constructed and maintained to standards in the California Forest Practice Rules, there would be a long-term moderate benefit to the floodplain of Redwood Creek. Removal and upgrade of stream crossings and unstable road segments would have a negligible benefit to the Redwood Creek floodplain, because Prairie Creek enters the Redwood Creek floodplain at a point where the floodplain is confined by flood control levees.

Riparian wetlands in the project area and along Redwood Creek and some of its more heavily logged tributaries, were degraded by early logging and road construction, and the combined effects of floods and road failures. Riparian areas along the mainstem of Prairie Creek were not as damaged as some other tributaries of Redwood Creek because the upper portion of the watershed within Prairie Creek Redwoods State Park was not logged. The greatest benefit to riparian wetlands outside the project area relies on the effectiveness of watershed restoration and improved forest practices to prevent landslide erosion that can topple and bury riparian trees and other vegetation with sediment.

Road removal and upgrades drain isolated wetlands that form behind blocked culverts, filled stream channels, ditches with no outflow, and slumps in road fills. These features can create ponds and puddles that serve as breeding habitat for some amphibians, which are adversely affected by loss of this habitat. The overall effect on the forest ecosystem is negligible because these wetlands are not an original component of the ecosystem and have very limited value as amphibian habitat. The adverse effect from loss of these wetlands is negligible compared to the potential adverse effects of loss of stream functions, including riparian wetlands, in the event of major road failures.

Effects on Vegetation—The vegetation in the project area was previously disturbed by clearcut logging and road building. Under both the no action alternative and the proposed action, vegetation growing along the road and trail would be occasionally trimmed and downed trees and limbs removed to maintain an open corridor. No other vegetation would be removed under the no action alternative. Therefore, the no action alternative would have a negligible effect on vegetation in the short-term. In the long-term, catastrophic failure of the stream crossings and road segments would cause loss of riparian vegetation along both Streelow Creek and possibly Prairie Creek. This effect would be adverse, indirect, and minor to moderate depending on the intensity of the storm that causes the failure.

Under the proposed action, approximately six acres of vegetation that has regrown following the original disturbance from road construction and logging would be removed by heavy equipment either during the excavation of culverts, stream crossings, and road segments, or in preparation for the earthmoving work. Of the approximate 630 trees that would be removed, 60 percent are alders, 20 percent are spruce, 15 percent are redwood and 5 percent are Douglas-fir. Most of the trees that would be removed are 4-12 inches dbh; the largest trees (alders) would be 20 inches dbh. The largest redwood to be removed is 18 inches dbh. No old-growth or mature conifers would be removed. The vegetation that would be removed is common in the project area. Vegetation along the road and trail is routinely cut or trimmed to maintain an open corridor. Understory vegetation would regrow within several months depending on the severity of the following winter and would be completely regrown within a few years. Removal of small trees encourages faster growth of remaining trees.

Newly disturbed soils would be covered with mulch to reduce erosion. To avoid importing unwanted exotic plants, vegetation cleared from the roadsides would be salvaged, stockpiled, and placed on the

newly disturbed sites after treatment. Revegetation would occur naturally from the local seed sources in the mulch and from the adjacent areas. Natural revegetation occurs quickly in the moist heavily vegetated project area.

Under the proposed action, the primary impact to vegetation is the removal of several hundred small trees that have regrown following clearcut logging in the 1960s. Roadside understory vegetation would be removed in conjunction with the road treatments, but most of the disturbed area is road surface that does not support vegetation or that has been routinely cleared. Road maintenance has continuously disturbed all vegetation adjacent to the corridors for many years and the entire area associated with the project has been previously logged. The overall effect on vegetation is adverse and minor from removal of trees. In the long-term, there would be a negligible benefit from enhanced growth of remaining trees.

Cumulative Effects on Vegetation—Cumulative effects on vegetation outside the project area include removal of vegetation along roads slated for removal in the Lost Man Creek watershed restoration project that was initiated in 2006 and will be completed in 2010 (NPS 2006a). Restoration on about 1,700 acres of second-growth forests in the Lost Man Creek drainage is also underway (NPS 2009b). The second-growth management is occurring in different areas of the Lost Man Creek drainage than the watershed restoration projects. Outside the watershed and forest restoration project areas, previously logged areas of the park would continue to recover although the recovery in some dense second-growth stands that were not thinned after replanting would require centuries to attain characteristics and functions associated with old-growth forest. Fire in the project area would be managed with a full suppression strategy, which will require preparation of several ridgetop roads to ensure access for fire engines and crews (NPS 2005). Fire road preparation includes brushing, culvert and ditch cleaning, and grading.

Sudden Oak Death (SOD) is a pathogen related to the pathogen that causes Port-Orford-cedar root disease and is spread in a similar manner from spores in water and wet soils that are typically moved by humans. SOD affects tan oaks, rhododendrons, California bay, and other important components of the park vegetation communities. SOD is not yet known within park boundaries but is known to occur both north and south of the park. The NPS is developing a program to deal with SOD when it inevitably reaches the park. The long-term effects of SOD on park vegetation are unknown but SOD has had significant adverse effects on oak woodlands in national and state parks in central California and the San Francisco Bay Area. Heavy equipment would be cleaned before entering the project area to prevent the spread of pathogens.

Effects on Wildlife—Under both the no action and proposed action, there would be long-term effects on wildlife from noise and disturbance associated with routine maintenance and use of the trail. Noise from U.S. Highway 101 is audible at the confluence of Streelow Creek and Prairie Creek. Typical wildlife that occupy the area such as winter wrens, varied thrushes, ravens, Steller's jays, black-tailed deer, Roosevelt elk, black bear, raccoon, and mountain lions are accustomed to the occasional presence of humans on the trail; other wildlife such as small mammals are rarely seen during daylight hours when humans are likely to use the trail. The adverse effect on wildlife from use and maintenance of the trail is negligible.

Under the proposed action, there would be adverse effects on sedentary wildlife that live within or immediately adjacent to the excavation sites from noise during construction and any soil or ground-dwelling organisms that live within the project site would be displaced or destroyed. The effect on wildlife species that are not tolerant of human presence and that can move out of the area would be adverse, short-term and negligible to minor depending on the species and its tolerance of humans. For those individuals that are permanently displaced from their territories or are killed by equipment, the adverse effect is long-term or permanent and major. There is sufficient habitat in the vicinity of the project area for persistence of all wildlife species and there would be no long-term adverse effect on park populations of any wildlife species. The overall adverse effect on wildlife from project related excavations or trail construction would be negligible. The long-term effect on wildlife in the project area

would be a negligible to minor benefit from reduction of the potential for catastrophic slope failures from unstable road fill.

Cumulative Effects on Wildlife—The logging that occurred in the project area prior to park establishment and expansion had significant adverse effects on certain terrestrial and aquatic species of wildlife. Small terrestrial species that are less mobile were directly affected by logging. More mobile wildlife species were indirectly affected by widespread loss of forest habitat and damage to streams. Aquatic species were directly affected where stream channels were blocked with Humboldt crossings and indirectly affected by loss of shade when the forest canopy was removed and by sedimentation of streams from landslides and erosion from bare soil areas. The adverse effects of sedimentation continued after forest vegetation regrew. Several species that suffered major population declines from loss of forest habitat due to logging throughout their range were listed as threatened under the federal or California endangered species acts.

Effects on Sensitive, Threatened or Endangered Species—There are no state or federally listed plants in the project area that would be affected by either the no action alternative or the proposed action.

The proposed action may affect but is not likely to adversely affect northern spotted owls. No suitable nesting or roosting habitat would be removed, and any trees in suitable roosting or nesting habitat would be cut between February 1 and July 9. Suitable nesting and roosting habitat would be degraded but the effects would be negligible because the total area to be affected is 9.2 acres distributed along the 1.8-mile corridor; trees to be removed are less than 24 inches dbh with most less than 12 inches dbh; no potential nest trees would be removed; and habitat suitability and function would be maintained. There would be negligible effects from noise disturbance because a daily limited operating period for equipment producing greater than ambient noise would be imposed between February 1 through July 9 in or within 0.25-mile of unsurveyed or occupied nesting and roosting habitat.

The proposed action may affect but is not likely to adversely affect marbled murrelets based on the following. No suitable nesting habitat or nest trees would be removed. Less than 0.25-acre of suitable nesting habitat would be degraded but this effect would be negligible because the trees to be removed are few and do not provide canopy for potential nesting platforms, and habitat suitability and function would be retained. There would be no disturbance to nesting murrelets because no project-generating noise would occur in or within 0.25-mile of suitable nesting habitat from March 24 through September 15. There would be no additional harassment from humans or harm from increased corvid predation because the trail is already open to human use.

These adverse effects on marbled murrelets and northern spotted owls are considered negligible.

Cumulative Effects on Threatened Birds—Timber harvest is on-going on private timberlands adjacent to the park. Spotted owls and/or marbled murrelets that nest in habitat adjacent to private timberlands would continue to be subject to increased noise disturbance from heavy equipment and helicopter logging operations on private lands, or from increased predation threat.

Cumulative effects on northern spotted owls would result from continued loss of suitable habitat and from increasing competition with barred owls, which are expanding their range and are considered to constitute the most imminent threat to the recovery and continued survival of northern spotted owl populations.

Effects on Threatened Fish—Three federally listed as threatened salmonids (Southern Oregon/Northern California Coast coho salmon, California Coastal chinook salmon, and the Northern California steelhead) occupy the project area during some life stage. Coho salmon are also listed as threatened by the state of California.

Trail and road maintenance activities on the Streelow Creek Trail under either no action or the proposed action following road improvements would have negligible short-term adverse effects on listed fish.

Under the no action alternative, there would be no construction-related effects on fish. As the road and drainage structures deteriorate, there is long-term potential for adverse effects from chronic turbidity from erosion and from road failure if sediment is delivered into the creek. These effects range from negligible to significant, depending on the timing and extent of erosion and road failure.

The proposed action has the potential to affect these listed threatened fish species and designated critical habitat for coho and steelhead. Effects on listed salmonids and their designated critical habitat were analyzed in an NPS biological assessment dated August 24, 2009. NOAA Fisheries' Biological Opinion agreed with the NPS determination that the project is not likely to jeopardize the continued existence of coho salmon, Chinook salmon, or steelhead; and is not likely to result in the destruction or adverse modification of designated critical habitat for coho salmon or steelhead.

The proposed action would have long-term benefits to coho and Chinook salmon and steelhead trout and to designated critical habitat for these species from reducing the potential for failure of road segments and stream crossings, and replacing undersized drainage structures with structures that can accommodate 100-year flow events. These improvements would reduce the potential for erosion at stream crossings where sediment would be delivered directly to streams in the event of crossing failure.

Short-term adverse effects on listed salmonids and their habitat from instream work and increased turbidity in the first season following restoration activities would be minimized by use of best management practices typically applied to park watershed restoration and road maintenance projects (Appendix A). The short-term adverse effects would be negligible to minor.

The long-term effects on listed salmonids in the project area from removing unstable failing road segments, improving drainage structures, and increasing the stability of the underlying road benches to reduce the threat of erosion would be beneficial and moderate.

Cumulative Effects on Fish—Anadromous fish throughout the Pacific Northwest region are threatened by the cumulative impacts of livestock grazing, road construction, timber harvest, stream channelization, water diversions, hydroelectric development, overfishing, and the influence of hatchery fish on both disease resistance and genetic fitness of native stocks (USDC 1997, 1999b, and 2000).

Though few scientific data are available for accurate estimates of past salmonid populations in Redwood Creek, the limited data available indicate that the anadromous fishery of Redwood Creek has experienced a substantial reduction during the last 30 years. Present populations of salmonid species are well below those reported in historical accounts. The earliest accounts circa 1890 reported Redwood Creek as having supported a substantial salmon fishery (Van Kirk 1994).

Degraded stream habitat is a major contributor to the decline in numbers of salmon and trout. The combined effects of timber harvest (i.e., removal of forest cover and construction of logging roads) and flood-producing storms deposited large amounts of sediment in Redwood Creek and its tributaries and degraded habitat. Gully and landslide erosion caused sedimentation of the mainstem that filled deep pools, and major floods caused significant channel adjustments including channel widening, aggradation, and bank erosion. The resultant widened streambed and shallow riffles provided little or no cover for fish. Sedimentation negatively affects egg survival and fry emergence, and fish food organisms; i.e., benthic invertebrate production. The relatively unlogged Prairie Creek watershed in Prairie Creek Redwoods State Park was negatively affected by a large influx of fine sediment in 1989 from erosion of

the U.S. Highway 101 Redwood Park Bypass construction project during an early winter storm. Other factors contributing to and exacerbating population declines are overfishing and the prolonged effects of past hatchery practices, and natural events including severe floods, extended drought, and poor ocean conditions.

The Redwood Creek Total Maximum Daily Load (EPA 1998) describes fish populations in Redwood Creek as "much reduced" compared to historic accounts. Habitat conditions are still degraded relative to pristine conditions but are showing signs of improvement. Although channel deepening and pool development have been observed in all but the lower few miles of Redwood Creek, the mainstem generally lacks an adequate pool-riffle structure and cover. Coarse sediment deposited in the mainstem allows a large proportion of the summer base flow to infiltrate and flow subsurface, thereby limiting the surface water available to fish and increasing surface water temperatures. Spawning habitat in Redwood Creek is slowly improving as gravels are cleaned of fine sediment. Water temperatures in the tributaries are generally suitable for salmonids but suboptimal along much of the mainstem.

Using the guidelines for project implementation outlined in the current and previous biological assessments and terms and conditions specified in associated biological opinions, cumulative adverse effects to anadromous fish or their habitat throughout the park are expected to be minor and short-term. Long-term benefits to listed fish are expected from the reduction of threats associated with erosion and sedimentation of streams resulting from failure of untreated roads and stream crossings, and from restoration of drainage patterns.

Methodology to Assess Effects on Cultural Resources

Cultural Resources are defined as archeological resources, prehistoric or historic structures, cultural landscapes, and traditional cultural properties. These resources are called "Historic Properties" when they are either listed in or are determined eligible for listing on the National Register of Historic Places under §106 of the National Historic Preservation Act (36 CFR 800, *Protection of Historic Properties*). Criteria for determining eligibility of listing such resources on the National Register include the following:

Potential impacts to historic properties either listed in or eligible to be listed in the National Register of Historic Places for this project were identified and evaluated in accordance with the Advisory Council on Historic Preservation's regulations implementing §106 of the National Historic Preservation Act (36 CFR 800, *Protection of Historic Properties*): by (1) determining the area of potential effects; (2) identifying resources present in the area of potential effects that are National Register listed or eligible; (3) applying the criteria of adverse effect to affected resources; and (4) considering ways to avoid, minimize or mitigate adverse effects.

Under the Advisory Council's regulations a determination of *no historic properties affected, adverse effect,* or *no adverse effect* must be made for historic properties. A determination of *no historic properties affected* means that either there are no historic properties present or there are historic properties present but the undertaking will have no effect upon them [36 CFR 800.4(d)(1)]. An *adverse effect* occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the National Register, e.g. diminishing the integrity (or the extent to which a resource retains its historic appearance) of its location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects caused by the alternatives that would occur later in time, be farther removed in distance or be cumulative [36 CFR 800.5(a)(1)]. A determination of *no adverse effect* means there is an effect, but the effect would not meet the criteria of an adverse effect, i.e. diminish the characteristics of the cultural resource that qualify it for inclusion in the National Register [36 CFR 800.5(b)].

Thus, the criteria for characterizing the severity or intensity of impacts to National Register listed or eligible archeological resources, prehistoric or historic structures, cultural landscapes, and traditional cultural properties are the §106 determinations of effect: *no historic properties affected*, *adverse effect*, or *no adverse effect*. A §106 determination of effect is included in the conclusion section for each analysis of impacts to National Register listed or eligible cultural resources.

Effects on Cultural Resources—No negative impacts to cultural resources are anticipated from either the no action (routine maintenance, grading and culvert replacement) or the proposed action because the work would be confined to areas of existing disturbance from recent logging and road construction and no significant cultural resources were identified in the project area.

In terms of 36 CFR 800 the implementing regulations of the National Historic Preservation Act, no historic properties were identified within the APE of the proposed project as described in the Cultural Resources Inventory Report prepared by Kathleen Sloan 2009 (Sloan 2009). Although there were two 1940s vehicles found within the APE, these were determined to be so deteriorated that they retain no integrity sufficient to make them eligible for listing on the National Register of Historic Places. In addition, NPS has determined that Streelow Road was constructed in the 1960s and is therefore less than 50 years old making it ineligible for listing on the National Register of Historic Places. Therefore, NPS finds that no historic properties would be affected by the proposed project.

In the unlikely event that previously undocumented prehistoric or historic archeological resources (e.g. flaked stone, bone, shellfish, historic bottles and cans, old wooden structures) are encountered during project implementation, work in that area will be suspended until an archeologist qualified under the Secretary of the Interior Standards evaluates the find. In that event that such resources are encountered, the NPS would then further consult with the SHPO and the Yurok Tribe under standard 36 CFR 800 regulations.

Cumulative Effects on Cultural Resources—The proposed action would have no cumulative effect on cultural resources. Although cultural resources may occur in the vicinity of the Streelow Creek watershed that may be important cultural resources, no known significant cultural resources are located within the project area.

In addition, the proposed action would not change the treatment and/or management of archeological resources in Redwood National Park. Cultural resources throughout the remainder of the Redwood National Park would be unaffected.

Under the terminology of the implementing regulations of Section 106 of the National Historic Preservation Act (36 CR 800), no historic properties, determined eligible for or listed on the National Register of Historic Places, would be affected by the no action alternative or the proposed action.

Effects on Scenic Resources and Visitor Experience

There are no significant scenic resources in the project area. Under the no action alternative, the Streelow Creek Trail would not be closed for trail improvements. Thus, the no action alternative would not affect visitor enjoyment in the short-term. In the event of continued culvert and road surface failures, the bike-hike trail would be closed temporarily and visitors would be unable use the Streelow Creek Trail to reach Gold Bluffs Beach and Fern Canyon until repairs can be made. The length of closure would depend on the availability of funding to make repairs. If failures result from catastrophic failures during a major storm, other roads and trails are likely to be affected and the closure could potentially be substantially longer than under the proposed action.

Under the proposed action, the Streelow Creek hike-bike trail would be closed for a two year period. This would be a temporary adverse effect on park visitor use from trail closure until the project is completed. However, the Davison Trail and other park bicycle routes would be available as alternatives to the Streelow Creek Trail as a bike-hike trail (Figure 3). The adverse effects on opportunities for visitor enjoyment in the park from closure of the Streelow Creek hike-bike trail would be moderate.

The proposed action would improve visitor safety and enhance the visitor experience. Along the road-to-trail conversion segment of road, a more natural setting for the trail would be created by excavating road fill from stream crossings, reshaping the ground surface to more fully blend with surrounding topography, and installing attractive foot bridges with good walking-riding surfaces and handrails. Along the upgrade segment of this project, visitor safety and experience would be improved by outsloping the road surface with rolling dips to improve surface drainage that would eliminate the mud holes commonly found along the trail. Improved surface drainage would decrease the likelihood of road slumps which offset the road and trail surface.

The project would have long-term moderate benefits to visitor safety and experience. Depending on whether trail users prefer this trail to other park trails, the proposed action would have minor to moderate adverse effects on visitors from trail closures for two years during trail construction.

Effects of the Alternatives on Park Operations and Socioeconomics

Under the no action alternative, routine trail and road maintenance would occur under current funding and personnel levels. This would include filling of holes and grading of slumps as they develop, and clearing of culvert inlets. There would be no additional cost associated with planning or implementing a program that improves road and trail conditions and prevents erosion from these roads.

Under the proposed action, there would be negligible, short-term impacts on park operations. Administrative functions would be needed, mostly related to the park's contracting office. Geology staff would oversee and monitor project implementation as either the project manager, if work is completed by park staff, or as the Contracting Officer's Technical Representative (COTR) if work is completed under contract. The maintenance division may implement portions of this project with park staff or contract all services. Under the proposed action, there would be an increase in government spending for materials such as culverts, rock, and lumber and, possibly for contracted services that could include site clearing and general earthmoving work. The total cost of implementing the proposed action is estimated at $408,000. The total cost might be offset slightly if excess trees cleared from the work sites are used as partial payment for contracted services.

Conclusions on Effects on Park Operations and Socioeconomics—Under the no action alternative there would be no impact to park operations or socioeconomics and no benefit to the local economy. Under the proposed action, normal park functions would be affected, but not beyond the scope and capabilities of the park to implement such projects. There would be an economic benefit to the local economy from the purchase of materials including culverts, rock and lumber and, possibly, from contracted services.

Non-Impairment of Park Resources

The NPS is prohibited by law and policy from taking an action that will impair park resources or values. NPS *Management Policies 2006* (NPS 2006e) require the NPS to assess and disclose whether a proposal has the potential to impair park resources or values. This section discusses the effects on resources under the proposed action and why those effects would not impair park resources or values. The potential for impairment under the no action alternative is also discussed.

The impairment that is prohibited by the Organic Act (16 USC 1) and the General Authorities Act (16 USC 1a-1) is an impact that, in the professional judgment of the responsible NPS manager, would harm

the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. Whether an impact meets this definition depends on the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts.

An impact to any park resource or value may, but does not necessarily, constitute an impairment. An impact would be more likely to constitute impairment to the extent that it:

- affects a resource or value whose conservation is necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, or
- is key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or
- is identified in the park's general management plan or other relevant NPS planning documents as being of significance.

An impact would be less likely to constitute an impairment if it is an unavoidable result of an action necessary to preserve or restore the integrity of park resources or values and it cannot be further mitigated.

Some of the short-term effects associated with ground disturbance to improve the Streelow Creek Trail are considered to be adverse. These effects are unavoidable to reduce long-term threats from road erosion to water quality, stream and riparian functions, and threatened fish species and their habitat. The short-term adverse effects on streams and threatened fish can be mitigated through best management practices such as erosion control, timing of the project, and relocation of fish if stream dewatering is needed (Appendix A). The long-term adverse effects from not removing failing drainage structures or road segments would be longer-lasting and more intense than the short-term effects. These long-term adverse effects are considered unacceptable, particularly in the context of the legislation that established and expanded Redwood National Park which directs the NPS to rehabilitate areas within the park "contributing significant sedimentation because of past logging disturbances and road conditions, and to the extent feasible, to reduce the risk of damage to streamside areas…." (16 USC 79j).

Non-Impairment of Air Quality—Under the no action alternative, there would be negligible adverse effects on air quality or air quality related values in the park from emissions from vehicles and equipment used for maintenance of the Streelow Creek Trail. The no action alternative would not impair air quality or air quality related values in the park.

Under the proposed action, there would be short-term localized adverse effects on air quality from dust from excavation of road fill, and from emissions from construction vehicles and motorized equipment. These effects would be negligible and, therefore, the proposed action would not impair air quality or air quality related values of the park.

The adverse effects on air quality from dust and vehicle emissions under either no action or the proposed action are short-term and localized. These impacts are negligible, and therefore acceptable.

Non-Impairment of Soils and Topography—Under the no action alternative, sediment would continue to erode from the road and stream crossings. The soil resources in the project area were previously disturbed through logging and road construction. Road construction altered the original topography but the alteration within the small project area does not approach the level of impairment. However, the widespread alteration of soils and topography from road construction and logging throughout the park, especially tractor logging, and the resulting road related landslides are considered an impairment. The no action alternative would not reduce the overall impairment to soils and topography throughout the park that resulted from logging and road construction prior to park establishment and expansion.

Under the proposed action, 11,620 cubic yards of soil would be excavated from stream crossings and the associated road segments. These soils are previously disturbed by logging and road construction, and are road fill or aggraded material that has washed downstream from logged slopes and abandoned logging roads. Therefore, excavation of soils and restoration of topography in small areas around stream crossings under the proposed action would not impair or derogate park values but would reduce the overall impairment to soils and topography by a negligible amount.

The adverse effects on soils under the no action alternative that could result from failure of the stream crossings and associated road segments would not be significant because these soils are previously disturbed by the original road construction. Further, failure of the crossings and associated road segment would contribute to the existing impairment of park watersheds. Therefore, these impacts on soils from culvert failure under no action would be unacceptable because soils are a critical component of watersheds whose conservation is necessary to fulfill specific purposes identified in the establishing legislation of the park, and are identified in the park's general management plan as being of significance.

The adverse effects on soils under the proposed action from removal of the stream crossings and associated road segments would not be significant because these soils are previously disturbed by the original road construction. The long-term effects on soils and topography from excavation, removal to stable areas, and recontouring to blend into original topography would be beneficial and therefore acceptable. The short-term adverse effects on soils are acceptable because these effects are needed to prevent more intensive adverse effects from road and crossing failure, and because soils are a critical component of watersheds whose conservation is necessary to fulfill specific purposes identified in the establishing legislation of the park, and are identified in the park's general management plan as being of significance.

Non-impairment of Water Quality, Hydrology, Floodplains, and Wetlands—Under the no action alternative, there would be continued long-term adverse effects on water quality and hydrology of Streelow Creek and Prairie Creek during and following rain events large enough to cause erosion of stream banks that have been altered by previous logging, the associated roads, and the stream crossings. Water quality and hydrology in Streelow Creek and potentially Prairie Creek would be impaired in the event of a catastrophic failure of any of the stream crossings or the road, and might be impaired for many years by a road fill failure that is less than a complete catastrophic failure. The hydrology (capacity and orientation of the drainage system) upslope of the creek would continue to be adversely affected under the no action alternative. These resources are currently impaired from past logging and road-related erosion although the impairment is gradually lessening as watershed restoration projects are completed and vegetation regrows on soils exposed by road construction and clearcut logging.

Under the no action alternative, there would be adverse effects to the floodplain and the riparian wetlands along Streelow Creek and potentially Prairie Creek in the event of catastrophic failure of the road or stream crossings. If the crossings or road fail catastrophically, riparian wetlands and the floodplain would be adversely affected from deposition of sediment into the riparian zones, and the floodplain would be blocked when the road fill is deposited directly into the stream channel. In periods of heavy rainfall, drainage from the road surface and the crossings would erode sediment which would enter the creek directly, which would contribute to the impairment of Streelow Creek and to a lesser extent, of Prairie Creek,

Therefore, the no action alternative has the potential to worsen the existing impairment to water quality, hydrology, the floodplain, and riparian wetlands of Streelow Creek, and Prairie Creek to a lesser extent, in the event of a catastrophic failure of a stream crossing or the associated road segment.

Under the proposed action, there would be unavoidable localized short-term adverse effects on water quality in streams and associated riparian wetlands from removal of stream crossings and road segments. These adverse effects are similar in intensity and duration to those that result from a moderate rain event. There would be a long-term moderate benefit to water quality, hydrology, the floodplain, and riparian wetlands in Streelow Creek from removal of the stream crossings and the road segments that alter the original drainage patterns and pose an erosional threat. Therefore, the proposed action would not cause additional impairment to water quality, hydrology, the floodplain, and riparian wetlands in Streelow Creek and would reduce the potential for impairment to these resources related to the stream crossings and the road segment in the immediate vicinity of the project site on Streelow Creek. There would be a long-term reduction to the impairment to water quality, hydrology, the floodplain, and riparian wetlands in Prairie Creek downstream of the project site.

The overall impairment to hydrology, water quality, floodplains and riparian wetlands in heavily logged areas in the Redwood Creek watershed, outside of the Prairie Creek watershed, would not be reduced by the proposed action. The overall impairment is being gradually reduced through watershed restoration projects in the Redwood Creek watershed both within and upstream of the park, and through application of regulations for the proper design, construction, and maintenance of roads associated with timber harvest outside the park.

The adverse effects on hydrology, water quality, floodplains, and riparian wetlands under the no action alternative that could result from failure of the stream crossings and associated road segments would be locally significant and would contribute to the existing impairment of park watersheds. Therefore, these impacts on hydrology, water quality, floodplains and riparian wetlands from culvert and road failure under no action would be unacceptable because the conservation of watersheds is necessary to fulfill specific purposes identified in the establishing legislation of the park, and watersheds are identified in the park's general management plan as being of significance.

The adverse effects on hydrology, water quality, floodplains, and riparian wetlands under the proposed action from removal of stream crossings and road segments would not be significant because these impacts would be minimized through application of best management practices to avoid or control soil erosion. Any construction near a perennial stream or anywhere where exposed soils could potentially erode into a stream would be implemented under the best management practices required under the NOAA BO. These adverse effects are acceptable because they are a direct result of water restoration techniques that are necessary to fulfill specific purposes identified in the establishing legislation of the park, and watersheds are identified in the park's general management plan as being of significance.

Non-impairment of Vegetation—Under the no action alternative, there would be no direct construction-related effects on vegetation. The vegetation is considered to be impaired by clearcut logging prior to park establishment and expansion. The no action alternative would have no effect toward reducing the impairment to vegetation resources. The impairment to old-growth redwood forest can only be reduced over centuries of regrowth.

Under the proposed action, removal of several hundred small trees and understory vegetation on about six acres is considered a minor adverse effect because this vegetation has regrown following clearcut logging and original road construction; the types and sizes of the trees to be removed and the understory vegetation is common in the park and routinely cut for annual trail and road maintenance; and the understory vegetation would re-establish by the next growing season and alders would re-establish within five years. Growth of remaining conifers in the project area would be enhanced but the effect would be negligible. No large mature conifers would be removed. Therefore, vegetation in the project area would not be impaired under the proposed action. The overall reduction to the impairment to park forests and to the surrounding forests in the project area would be negligible because the number and size of trees to be

removed is not sufficient to enhance growth of the remaining trees and because the trees are not being selected to maximize regrowth of remaining trees.

There would be no new adverse effects on vegetation under the no action alternative. Effects on vegetation that could result from failure of the culvert and the associated road segment would be minor because the vegetation has been previously disturbed by clearcut logging. However, the impacts on vegetation from potential road and crossing failure under no action would be unacceptable because vegetation is a component of watersheds whose conservation is necessary to fulfill specific purposes identified in the establishing legislation of the park.

The adverse effects on vegetation under the proposed action from improvements to the road and drainage structures would be negligible because the amount of vegetation that would be removed would be small, the vegetation has been previously disturbed by the original road construction and logging, and vegetation would quickly recolonize the newly restored streamsides. These adverse effects are acceptable because they result from an action needed to fulfill specific purposes of watershed restoration identified in the establishing legislation of the park, and that are identified in the park's general management plan as being of significance.

Non-impairment of Terrestrial Wildlife and Aquatic Biota—Under the no action alternative, there would be no direct effects on terrestrial wildlife or aquatic biota from removal of the culvert and associated road segment. Aquatic biota would suffer indirect adverse effects in the event of catastrophic failure of any of the culvert or associated road segment. In the event of catastrophic failure, aquatic biota in the downstream reaches of Streelow Creek would be impaired if the stream channel is completely buried with sediment. Catastrophic failure of the Streelow Creek stream crossings and road segments would likely be associated with widespread road and stream crossing failures throughout the park, leading to impairment of aquatic biota in Prairie Creek downstream of the project area. The no action alternative has the potential for localized impairment of aquatic resources in Streelow Creek, and potentially Prairie Creek.

There would be no adverse effects on terrestrial wildlife or aquatic biota under the no action alternative to the degree that no new disturbance would occur. Effects on aquatic biota that could result from failure of any of the stream crossings or associated road segments would be moderate to significant immediately downstream, depending on the degree of failure. However, the impacts on aquatic biota from failure of drainage structures or road segments under no action would be unacceptable because aquatic biota are a component of watersheds whose conservation is necessary to fulfill specific purposes identified in the establishing legislation of the park, and that are identified in the park's general management plan as being of significance.

Under the proposed action, soil-dwelling organisms and small sedentary non-threatened or endangered animals would be affected by removal of soils and vegetation. This is an unavoidable impact but the numbers of individual animals affected is very small in comparison to the total populations of these animals in the park and park populations of these species would not be affected over the long-term. Therefore, the proposed action would not cause an impairment to wildlife or aquatic biota.

Adverse effects on wildlife from removal of any of the stream crossings or associated road segments under the proposed action would be negligible and therefore are acceptable. The adverse effects on aquatic biota under the proposed action from removal of any of the stream crossings or associated road segments would be minor and localized. These adverse effects are acceptable because conservation and restoration of watersheds and associated aquatic biota from prevention of culvert and road failure are necessary to fulfill specific purposes identified in the establishing legislation of the park, and watersheds and aquatic resources are identified in the park's general management plan as being of significance.

Non-impairment of Sensitive, Threatened, and Endangered Species—Under the no action alternative, there would be no direct effects on sensitive, threatened, or endangered plants or terrestrial animals. The no action alternative has the potential for adverse effects on listed anadromous fish and their designated critical habitat. Under the no action alternative, designated critical habitat for the fish would continue to be adversely affected by chronic turbidity associated with erosion of failing road surfaces and stream crossings. If the stream crossings or the road segments fail, there could be direct adverse effects on fish particularly if failure occurs when fish are spawning or during early life stages that require clean water for successful growth and development. Any fish, redds, eggs or early life stages that are present in the stream in the event of culvert failure would be destroyed, which would be considered an impairment of the fish resources of Streelow Creek and potentially Prairie Creek. Catastrophic failure of the Streelow Creek stream crossing and road segments would likely be associated with widespread road and stream crossing failures throughout the park, leading to impairment of designated critical habitat over a larger area of the park, including Prairie Creek. Depending on the timing of a storm large enough to cause catastrophic failure of the culvert, there could be direct adverse effects on fish that might be present in the stream. The no action alternative has the potential for localized impairment of listed threatened fish resources and designated critical habitat and associated impairment of listed threatened fish and designated critical habitat in Prairie Creek downstream of the project area.

Under the proposed action, there would be no direct adverse impacts on adult fish during construction because the work would be accomplished when adult fish are not present. Should juvenile fish be observed in the stream when work is planned, standard best management practices outlined in the NOAA Fisheries BO would be used to capture and move juveniles out of the immediate work area.

Excavation of sediment from the stream crossings and road segment would directly affect designated critical habitat in the short-term by increasing turbidity but would have a long-term benefit to habitat from reducing the erosional threat posed by the culvert and the associated road segment, and from restoring the original configuration of the stream channel and hydrological pattern. Standard erosion control methods and best management practices would be used to minimize erosion of soils outside the stream channel and thus minimize deposition of excess sediment into Streelow Creek after the work is completed. For the first rainy season following stream restoration, there would be adverse effects on fish from reduced water quality due to increased sediment that washes out of the newly excavated stream channel as it adjusts to its original level and configuration. The overall benefit to fish from restoration and upgrade of stream crossings has been determined by NOAA Fisheries to outweigh the short-term adverse effects from increased turbidity from stream crossing and road excavations. Therefore, the proposed action would not constitute an impairment to the fish themselves or to designated critical habitat for listed fish species, and would reduce the level of impairment to critical habitat that has led to the listing of the fish as threatened species.

There would be no adverse effects on listed terrestrial wildlife under the no action alternative to the degree that no new disturbance would occur in the project area. Effects on listed fish that could result from failure of stream crossings and the road would be moderate to significant downstream depending on the degree of failure and when the failure occurs in the spawning cycle of the fish. The impacts on listed threatened fish from culvert failure under no action would be unacceptable because the fish are an important component of watersheds whose conservation is necessary to fulfill specific purposes identified in the establishing legislation of the park, and anadromous salmonids are identified in the park's general management plan as being of significance.

Adverse effects on listed fish species and designated critical habitat from removal of stream crossings and associated road segments under the proposed action would be short-term and moderate. The overall benefit to fish from reduction of the erosional threat posed by the failing stream crossings and road segments has been determined by NOAA Fisheries to outweigh the short-term adverse effects of

excavation within and adjacent to the stream channel. Therefore, these adverse effects are acceptable. Furthermore, anadromous fish are an important component of park watersheds and protection of fish habitat by prevention of failures of stream crossings and roads is necessary to fulfill specific purposes of watershed protection and restoration identified in the establishing and expansion legislation of the park. Both watersheds and anadromous fish area identified in the park's general management plan as being of significance.

Non-Impairment of Cultural Resources—There are no significant cultural resources in the project area. Cultural resources would not be affected under either the no action or the proposed action and therefore, cultural resources would not be impaired.

Non-Impairment of Scenic Resources—There are no significant scenic resources in the project area that would be affected under either the no action or the proposed action and, therefore, scenic resources would not be impaired.

Coordination and Consultation

Public Distribution of the EA
The following officials, agencies, American Indian tribes and groups, and organizations received a copy of the environmental assessment or a letter announcing its availability and its location on the Internet, along with several individuals. Copies were available at libraries and park offices. All recipients are in California unless otherwise noted.

Congressman Mike Thompson
Assemblyman Wes Chesbro
State Senator Patricia Wiggins
Del Norte County Board of Supervisors
Humboldt County Board of Supervisors

NOAA Fisheries (NMFS), Arcata
US Army Corps of Engineers, Eureka
USFWS, Arcata

Big Lagoon Rancheria, Trinidad
Elk Valley Rancheria, Crescent City
Resighini Rancheria, Klamath
Trinidad Rancheria, Trinidad
Yurok Tribe, Klamath

California Department of Fish and Game, Eureka
California Department of Fish and Game, Redding District Office
California State Office of Historic Preservation, Sacramento
North Coast Regional Water Quality Control Board, Santa Rosa

Back Country Bicycles, Crescent City
Big Foot Bicycling Club, McKinleyville
Blue Ribbon Coalition, Oakley
California Native Plant Society, Arcata
California Trout, McKinleyville
Department of Environmental and Natural Resource Sciences, Humboldt State University, Arcata

International Mountain Bicycling Association, Boulder, Colorado
Northcoast Environmental Center, Arcata
Orick Chamber of Commerce, Orick
Orick Community Services District, Orick
Redwood Community Action Agency, Eureka
Redwood Region Audubon Society, Arcata
Save-the-Redwoods League, San Francisco
Sierra Club Redwood Chapter North Group, Arcata
Smith River Alliance, Crescent City
The Nature Conservancy, San Francisco

Del Norte County Public Library, Crescent City
Humboldt County Library, Arcata
Humboldt County Library, Main Branch, Eureka
Humboldt County Library, McKinleyville Branch, McKinleyville
Humboldt State University Library, Arcata

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Appendix A–Best Management Practices to Minimize Project Effects on Water Quality and Fish

Best management practices to minimize project effects on fish include best management practices to minimize erosion and the NMFS (USDC 2001) protocol for fish relocation and diversion if stream dewatering is required.

Best Management Practices to Minimize Erosion
The following best management practices (BMPs) were developed for the Lost Man Creek Watershed Restoration Project which began in 2006 and is expected to continue through 2010 (NPS 2006a, NPS 2006d.) These BMPs are implemented for all NPS projects that have the potential to affect listed salmonid species or their habitat within the park.

Riparian cover on fish-bearing streams and where non-fish bearing streams lead immediately into fish-bearing waters will be protected wherever reasonably feasible, balancing quality and benefits of the riparian cover against risks of sediment delivery.

Effective erosion control measures shall be in place at all times during restoration activities. Activities within the 5-year floodplain of fish-bearing streams will not begin until all temporary erosion controls (e.g., straw bales, silt fences that are effectively keyed in) are in place, downslope of project activities within the riparian area. Erosion control structures shall be maintained throughout, and possibly after, activities. Erosion control devices such as check dams, silt fences, and other acceptable techniques shall be used when the potential exists to have sediment or other materials entering bodies of water.

- Any disturbed ground must receive appropriate erosion control treatment prior to the beginning of the wet season.

- All non-emergency project work will be completed during the normal operating season (NOS), that is, between June 15 and October 15 of each year. If more than 0.5 inches of rain is forecast during the dry season, project operations will temporarily cease and sites will be winterized. If periods of dry weather are predicted outside of the NOS, additional small work items may be done, if they can be completed within the window of predicted dry weather. Only those repairs needed to reduce risks from active erosion will be undertaken outside of the NOS, in coordination with NOAA Fisheries.

- Work sites will be winterized at the end of each day when significant rains are forecast that may cause unfinished excavations to erode. Winterization procedures are supervised at all times by RNSP geologists and involve taking measures necessary to minimize erosion on unfinished work surfaces. Winterization includes the following: smoothing unfinished surfaces to allow water to freely drain across them without concentrating or ponding; compacting unfinished surfaces where concentrated runoff may flow with an excavator bucket or similar to minimize surface erosion and the formation of rills; and installation of culverts, silt fences and other erosion control devices where necessary to convey concentrated water across unfinished surfaces, and trap eroded sediment before it leaves the work site. Adequate erosion control supplies (gravel, straw bales, shovels, etc.) shall be kept at all restoration sites to ensure excavated material is kept out of water bodies.

- Equipment, both hand tools and heavy equipment, will be inspected daily to check for leaks. Equipment that may leak lubricants or fuels into drainage will not be used until leaks are repaired. All equipment will be stored, serviced and fueled outside of riparian areas and away from stream crossings. Heavy equipment will be cleaned (e.g., power washed, steam cleaned) prior to use below the ordinary high water mark.

- A spill plan and materials for spill containment will be available to onsite personnel and all personnel shall know how to use them. In the event of a spill, work shall be stopped immediately, clean up shall begin and the appropriate authorities will be notified.

- Petroleum products, chemicals, fresh cement, deleterious materials, or water contaminated by the aforementioned shall not be allowed to enter flowing waters.

- Disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flows, shall be minimized during excavation.

- Streams with significant surface flow capable of sediment transport off-site must be diverted around excavation areas. The diverted flows shall be returned to their natural stream course as soon as restoration is complete and prior to the rainy season. Any turbid wastewater from project activities and de-watering is disposed of off-site in a location that will not drain directly into a stream channel or carry sediment-laden water into a stream channel.

Protocol for Fish Relocation and Dewatering
The following steps shall be followed in the listed order for coordinating timing of fish relocation and dewatering during stream crossing removal within the known range of anadromous salmonids and/or coastal cutthroat (USDC 2001).

a) When there is stream flow:
   i. Fish exclusion fencing shall be installed on the upstream edge of the work area, far enough from the construction area so as not to be disturbed by the construction activities.
   ii. A first attempt to capture fish stranded in the construction area upstream of the crossing shall be made using seine nets and dip nets, where possible, and, if necessary, electrofishing.
   iii. Install fish exclusion fencing downstream of the crossing, far enough downstream from the construction area so as not to be disturbed by the construction activities.
   iv. A first attempt to capture fish, stranded downstream of the construction area, shall be made using seine nets and dip nets, where possible, and, if necessary, electrofishing.
   v. After all of the fish found have been relocated, install a water diversion structure several feet downstream of the upstream exclusion fence. Divert stream flow to the downstream end of the culvert, ensuring stream flow through the lower pool while the upper pool is dewatered.
   vi. If necessary, begin dewatering the pool above the culvert. Siphon water off the top of the pool to keep the water in the pool as cool as possible and prevent sucking sediment off the bottom. The water shall be pumped out of the channel and prevented from flowing back into the channel. As the pool is lowered, fish shall continuously be removed using seine nets and dip nets when possible before electrofishing.
   vii. After all of the fish found have been removed from the upstream construction area, the diversion shall be extended to just upstream of the lower fish exclusion fence, ensuring continuous stream flow downstream of the construction area. The lower pool shall be dewatered while continuously removing the stranded fish using seine nets and dip nets when possible before electrofishing.
   viii. Another attempt shall be made to capture any stranded fish the following morning.

b) If there is standing water but no stream flow, at the time of construction:
   i. Make the first attempt to remove fish both upstream and downstream of crossing using seine nets and dip nets before electrofishing.

ii. If necessary, begin dewatering pools above and below the crossing. Siphon water off the top of the pool to keep the water in the pool as cool as possible and to prevent stirring up sediment from the bottom. The water shall be pumped out of the channel and prevented from flowing back into the channel. As the pool is lowered, fish shall continuously be removed using seine nets and dip nets when possible before electrofishing.

c) For all dewatering, place pumps in flat areas well away from the stream channel. Secure pumps by tying off to a tree or stake in place to prevent movement by vibration. Refuel in an area outside of the active channel and place fuel absorbent mats under the pump while refueling. Pump intakes shall be covered with 2.38 mm (3/32 inch) mesh screen. Water drafting from fish-bearing streams will be conducted only within sites approved by a Park fishery biologist, and shall be done in accordance with NOAA Fisheries' *Water Drafting Specifications* (NOAA Fisheries, 2001).

d) The following procedures will be used for fish capture and relocation:

i. Prior to capturing fish, determine the most appropriate release location. Suitable areas shall be identified based on quality of habitat, risk of predation, stranding, and water quality using the following order of preference:
   1. In the same stream, upstream of the work area
   2. In the same stream, downstream of the work area
   3. In an adjacent but similar tributary
   4. In the mainstem stream

ii. Perform initial fish relocation efforts *3-5* days prior to the start of construction. This provides the qualified fisheries biologist an opportunity to return to the work area and perform additional electrofishing passes prior to construction. A second attempt, the morning following the initial endeavor, shall be made to capture any stranded fish.

iii. Exclude fish from re-entering work area by blocking the stream channel above and below the work area with fine-meshed net or screens. Mesh should be no greater than 1/8". It is vital to completely secure bottom edge of the net or screen to channel bed to prevent fish form re-entering work area. Exclusion fencing should be placed in areas of low water velocity to minimize impingement of fish. Screens should be checked periodically and cleaned of debris to permit free flow of water.

iv. Periodically measure air and stream temperatures. Cease activities when water temperatures exceed 68 degrees Fahrenheit.

v. Minimize handling of salmonids. When handling is necessary, always wet hands or nets prior to touching fish. Periodically measure air and stream temperatures. Cease activities when water temperatures exceed 68 degrees Fahrenheit.

vi. Place captured fish in cool, shaded, aerated, dark colored container filled with cool, clear water. Provide aeration with a battery powered external bubbler. Protect fish from jostling and noise and do not remove fish from this container until time of release. Release fish when the container reaches capacity or within one and a half hours after capture.

vii. Place a thermometer in the holding container, and periodically conduct partial water exchanges, if water temperature gets too warm or there is more than an hour of delay between when the holding container was brought to maximum capacity and the time of release.

viii. Avoid overcrowding in containers. Have at least two containers and segregate young of the year fish from larger age classes to avoid predation. Densities shall not exceed 5 fish per gallon of water in each container. If found, place large amphibians, such as Pacific Giant salamanders, in the container with the larger fish.

ix. Cease capture, and release listed salmonids when containers are filled to capacity.

x. Visually identify species and estimate year classes of listed salmonids at time of release. Do not anesthetize or measure listed salmonids.

xi. If mortality during relocation exceeds 5% of fish captured, stop efforts and immediately contact NOAA Fisheries.